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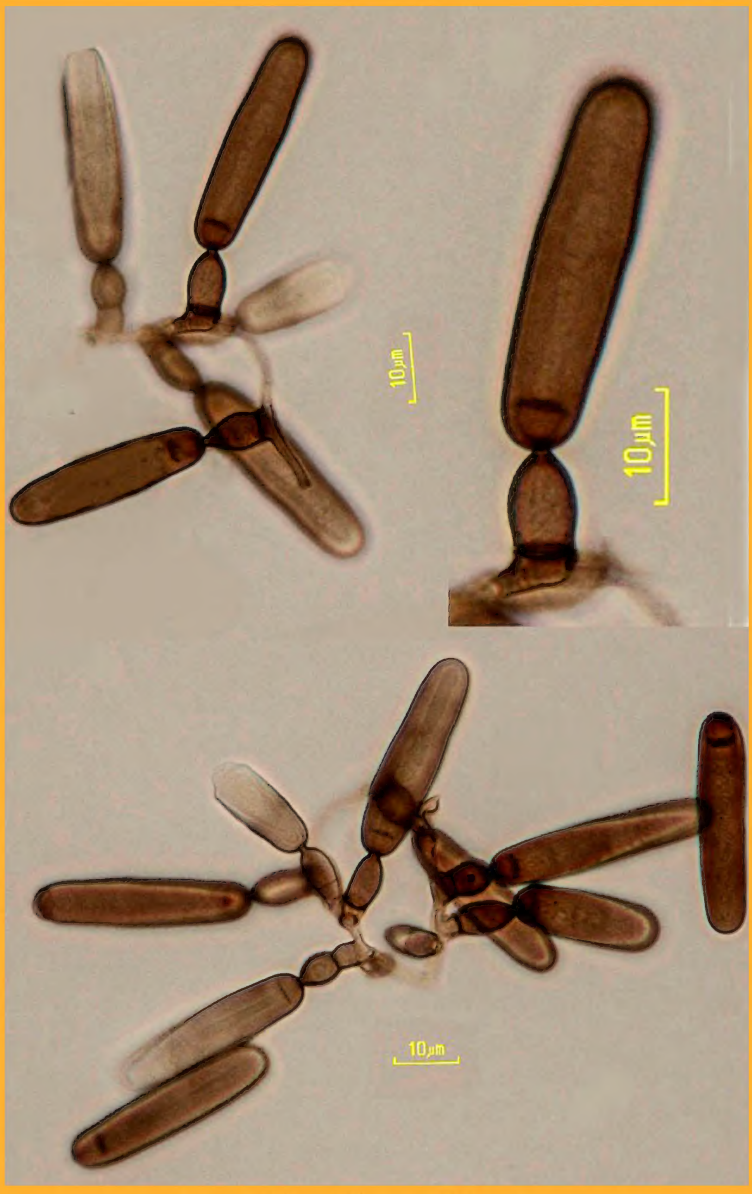

Anasporidesmiella manifesta sp. nov.
(Zhang & al. — FIG. 5, p. 725)

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MYCOTAXON

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[MB 832848], p. 723

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[MB 838125, orthographic correction], p. 793

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[MB 833030], p. 780
≡ *Helminthosporium cylindrosporum* Matsush. 1993, nom. illegit. (non Sacc. 1876)

Inocephalus appressus Largent
[MB 833283], p. 794

Leptonia cyanea (Sacc.) Largent
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R.F. Castañeda
[MB 833029], p. 780
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[MB833314], p. 794
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[MB 833082], p. 754
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[MB 833084], p. 755
≡ *Helminthosporium apicale* V. Rao & de Hoog 1896, nom. illegit.
(non Berk. & Broome 1861)
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[MB 833992], p. 896

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The Editors express their appreciation to the following individuals who have, prior to acceptance for publication, reviewed one or more of the papers prepared for this issue.

Ahmed M. Abdel-Azeem
N.S. Afshan
Flavia Rodrigues Barbosa
Timothy J. Baroni
Rafael F. Castañeda Ruiz
Maria Martha Dios
Patricia Oliveira Fiuza
Tine Grebenc
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Silvana Santos da Silva
Viacheslav Spirin
Steven L. Stephenson
Else C. Vellinga
Roy Watling
Ji-Wen Xia

Corrigenda

Mycotaxon 135(3)

p.689, line 4 from bottom

FOR: **Epitype:** MUCL 1208, designated as "neotype" by Hennebert, 1973; **isoepitype:** DAOM 74697).

READ: **Neotype:** MUCL 1208, designated by Hennebert 1973; **isoneotype:** DAOM 74697).

p.709, line 18

FOR: **Type:** ***Trichoderma*** *laeve* Pers.? [~~*laeve* Pers.?~~ scratched off] ***varium*** m. [mei] . . . .

READ: **Type:** ***Trichoderma varium*** ["~~*laeve* Pers.?~~", scratched off] m. ["mihi", i.e., Ehrenberg] . . . .

Corrigenda for Mycotaxon 135(4)

Cited below are mistakes present in files submitted for PDF conversion in the current issue but not detected by the authors until after the paper had gone to press.

p.811, line 17 FOR: *Sordiariomycetes* READ: *Sordariomycetes*

From the Editors

New range extension requirements—Mycotaxon's core subjects are fungal taxonomy and nomenclature. Despite our preference for monographic treatments, naming new taxa, and nomenclatural updates, we continue to accept carefully prepared range extension manuscripts that provide [1] a taxonomic heading including authorship, bibliographic reference, and figure references; [2] an original technical description based entirely on the new collections; [3] a standard Specimens examined section providing complete information on each collection (see below); [4] illustrations of the newly collected material (preferably photographs, but drawings accepted); and [5] a brief comparison of similarities/differences of the newly collected material with previously published descriptions and data representing the same taxon. We particularly stress the importance of comparing a new record with the type description to emphasize the original (and accurate) species concept.

Currently we receive too many manuscripts treating just one taxon represented by only a single collection accompanied by relatively superficial discussion. To encourage more thoughtful and valuable papers, Mycotaxon now excludes "thin" range extensions and henceforth will publish only range extensions that make a significant taxonomic contribution, both in number of species and number of specimens. Range extension papers must now cover two or more taxa, with each taxon represented by at least two collections from different sites supported by vouchering data and illustrations. Exceptions may be made for exceedingly rare taxa or those that serve as significant indicator species.

Partially decoding "specimens examined"—Our two 'densest' sections—the "Type" designation (in a new species paper placed below the taxonomic subheading, nomenclatural identifier, and diagnosis) and "[Additional] specimen/s examined" (standing between the technical description above and the Comments below)—provide all the essential information on material examined by the authors. But heavy use of abbreviations can make them difficult to interpret. Mycotaxon and many other journals organize the data as follows: [1] **Location data** are presented in an alphabetically arranged typographic hierarchy—**COUNTRIES: Provinces/ States/ Regions**; and **Districts/ Counties/ Municipalities/ Departments.** The hierarchy applies to consecutive localities as needed so that collections within the same area are grouped together, helping the reader rapidly determine the collection site. Location data also include geographic (latitude/longitude) coordinates and elevations. [2] **Collection data** provide additional site information (e.g., habitat, hosts/associates, soils, aspect, substrates, and collection dates, eventually ending with names of collectors & collector numbers. [3] **Vouchering data** provide all information concerning fungaria, culture collections, GenBank, etc.

The most important item in the presentation of a new species or infraspecies is the "Type" paragraph. Mycotaxon separates collector numbers from the all-important vouchering data by parentheses: e.g., "... 28 Dec 2020, J.H. Bloggs JHB12345

(**Holotype** HERB-Axxxx; **isotype** HERB-Zyyyyy; ex-type culture GHCCxxxxx; GenBank XYqqqqqq, XYqqqqqr)." The clear designation of a holotype is imperative for publishing a valid name.

Mycotaxon 135(4) contains 23 papers by 111 authors (representing 11 countries) as revised by 36 expert reviewers and the editors.

In the 2020 October–December Mycotaxon, authors propose 4 new genera (*Anasporidesmiella, Mirohelminthosporium, Varioseptispora* from China and *Similitrichoconis* from Ecuador) and 15 other taxa new to science representing *Anasporidesmiella, Bactrodesmium, Blodgettia, Corynespora, Lylea, Trapelia,* and *Varioseptispora* from China; *Beltrania, Similitrichoconis,* and *Zanclospora* from Ecuador; *Inocephalus* and *Leptonia* from the United States; *Phaeocandelabrum* from Brazil; and *Russula* from Pakistan. We also offer 14 new combinations and/or new names in *Anasporidesmiella, Calliderma, Clitopiloides, Fibropilus, Helminthosporium, Leptonia, Mirohelminthosporium, Nolanea,* and *Varioseptispora.*

New species range extensions are reported for [ascomycetes] *Camarops* in Russia and *Quadracaea* in India; [basidiomycetes] *Hericium* and *Jahnoporus* for Pakistan; [lichens] *Lecanora, Porina, Protoparmeliopsis, Rhizocarpon,* and *Rhizoplaca* for China; and [myxomycetes] *Arcyria*, *Badhamia*, *Cribraria*, *Fuligo*, and *Physarum* for Argentina. Papers providing conclusions supported by sequence analyses include two new species representing *Russula* and *Trapelia* and range extensions for *Hericium* and *Jahnoporus.*

Mycotaxon 135(4) also provides synoptic tables and keys to species in *Corynespora, Lylea, Trapelia,* and *Varioseptispora* as well as some long anticipated nomenclatural updates for Largent's 1994 Entolomatoid fungi of western North America and Alaska. Finally, we announce one new www.mycotaxon.com mycobiota covering coprophilous and other 'dung' fungi in Brazil.

Farewell to 2020—This past year is almost certainly one none of us care to repeat. While your New Zealand and Oregon editors escaped Covid-19, many authors and reviewers were not as lucky. We personally endured lockdowns, isolation, power outages, windstorms, uprooted trees, raging forest fires, dangerously unhealthy smoke-filled air while one side of the Pacific suffered interminable and highly unpleasant political tantrums and the other managed the Pandemic and conducted its elections with enviable serenity and maturity. The year had one final 'kick' to Mycotaxon when at the last minute the Editor-in-chief discovered to her horror that she had mispaginated the entire issue. A hasty renumbering of 200 pages was completed, and the Editor in question consoled herself that perhaps a new issue arriving just after New Year 2021 instead of at the end of a battered 2020 is a Good Thing.

Best wishes and warm regards throughout our healthy new year!

Shaun R. Pennycook (*Nomenclature Editor)*
Lorelei L. Norvell (*Editor-in-Chief*)
28 December 2020

2021 Mycotaxon submission procedure

Prospective Mycotaxon authors should download the Mycotaxon 2021 guide, review & submission forms, and Mycotaxon sample manuscript by clicking the 'file download page' link on our Instructions to Authors page before preparing their manuscript. This page briefly summarizes our '4-step' submission process.

1—Peer review: Authors first contact peer reviewers (two for journal papers; three for mycobiota/fungae) before sending them formatted text & illustration files and the appropriate 2021 Mycotaxon journal or mycota reviewer comment form. Experts return revisions & comments to both the *Editor-in-Chief* <editor@mycotaxon.com> and authors. All co-authors must correct and *proof-read* their files before submitting them to the *Nomenclature Editor*.

2—Nomenclatural review: Authors email all **error-free** text & illustration files to the *Nomenclature Editor* <PennycookS@LandcareResearch.co.nz>. Place **first author surname** + **genus** + 'Mycotaxon' on the subject line, and (required) attach a completed submission form. The Nomenclature Editor will (i) immediately assign the accession number and (ii) after a few weeks return his notes and suggested revisions to the author(s) and *Editor-in-Chief*.

3—Final submission: All coauthors thoroughly revise and proof-read files to prepare error-free text and images ready for immediate publication. Poorly formatted copy will be rejected or returned for revision. E-mail the final manuscript to the *Editor-in-Chief* <editor@mycotaxon.com>, adding the **accession number** to the message and **all** files, which include a **(i)** revised 2021 submission form, all **(ii)** text files and **(iii)** jpg images, and **(iv)** FN, IF, or MB identifier verifications for each new name or typification. The *Editor-in-Chief* acknowledges submissions within two weeks of final submission but requests authors to wait at least 14 days before sending a follow-up query (without attachments).

4—Final editorial review & publication: The *Editor-in-Chief* conducts a final grammatical and scientific review and returns her editorial revisions to all expert reviewers and coauthors for final author approval. Author-approved files are placed in the publication queue.

The PDF proof and bibliographic & nomenclatural index entries are sent to all coauthors for final inspection. After PDF processing, the *Editor-in-Chief* corrects only PDF editorial/conversion and index entry errors; corrections of all other errors are listed in the Errata of a subsequent issue for no charge. Authors will pay fees for mycobiota uploads, optional open access, and correction of major author errors to the *Business Manager* <subscriptions@mycotaxon.com> at this time.

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Anasporidesmiella gen. nov. for an atypical *Sporidesmiella* species and for *A. manifesta* sp. nov.

Kai Zhang[1,2], Weihua Guo[1*], Gabriela Heredia[3], José P. Delgado-Zúñiga[4], Jian Ma[5], Rafael F. Castañeda-Ruiz[6]

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Abstract—The authors describe and illustrate new genus, *Anasporidesmiella*, typified by *Sporidesmiella angustobasilaris* [≡ *A. angustobasilaris*, comb. nov.], and a new species, *A. manifesta*. *Anasporidesmiella* is characterized by macronematous mononematous brown conidiophores frequently reduced to monoblastic determinate conidiogenous cells and solitary cylindrical distoseptate brown conidia with truncated or rounded bases. *Anasporidesmiella manifesta* is distinguished by cylindrical 7–12-distoseptate reddish-brown conidia with rounded basal cells. Several illustrations of conidiogenous cells and conidia of the *Sporidesmiella* species complement the discussion of the new genus.

Key words—asexual *Ascomycota*, hyphomycetes, systematics

Introduction

Kirk (1982), who established *Sporidesmiella* P.M. Kirk with *S. claviformis* P.M. Kirk as type species, included five other species and one variety.

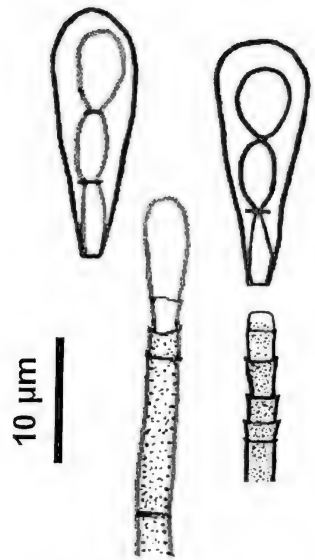
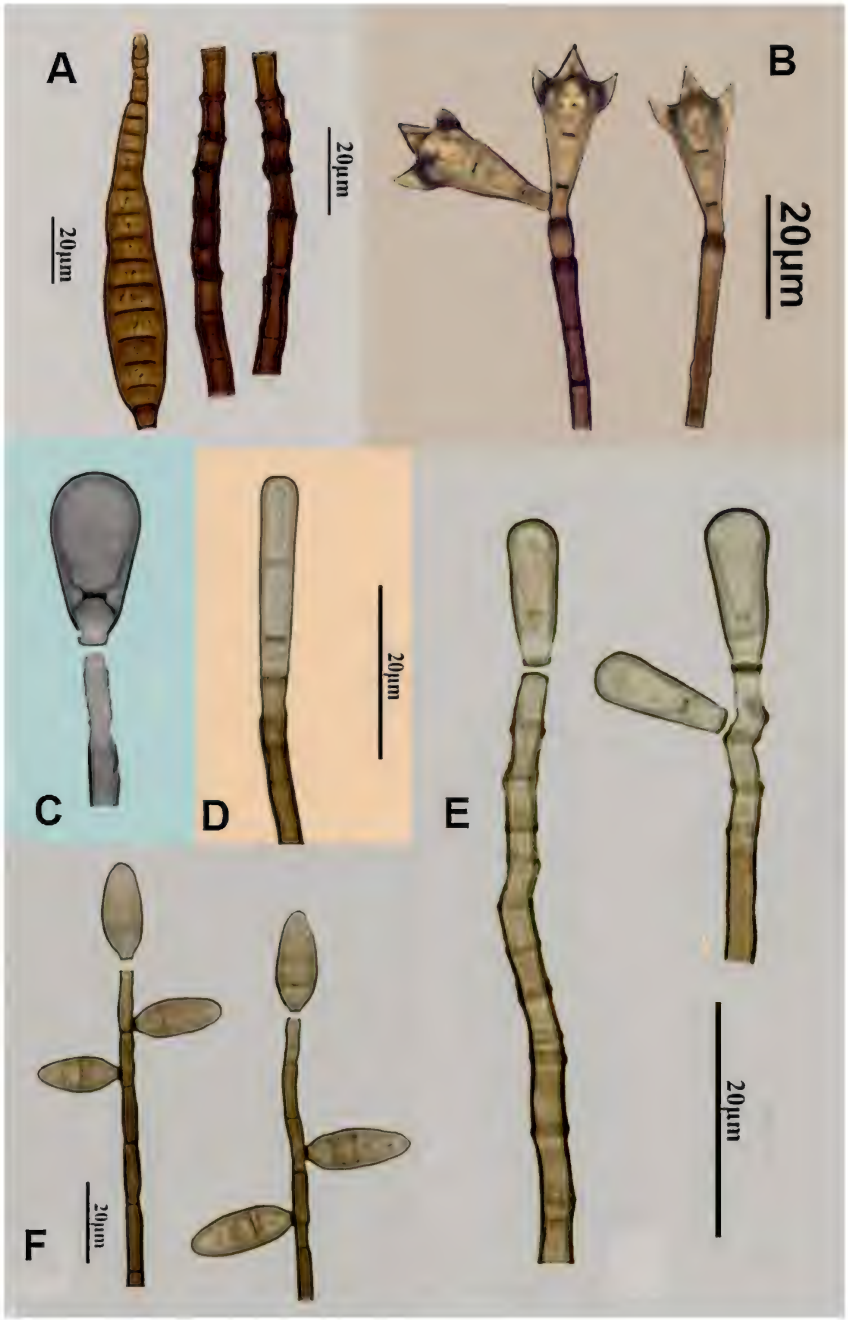


Fig. 1. *Sporidesmiella claviformis* (adapted from Kirk 1982: Fig. 1). Conidiogenous cells and conidia.

Sporidesmiella is distinguished by macronematous mononematous septate brown conidiophores and monoblastic terminal integrated indeterminate conidiogenous cells with numerous enteroblastic percurrent extensions. False sympodial elongations are occasionally observed where older conidia remain attached while a new enteroblastic extension of the conidiogenous cell produces a young conidium, which displaces the older conidium laterally. Such elongations can be repetitive, causing the main conidiophore axis to appear geniculate. *Sporidesmiella* (Kirk 1982) is also characterized by conidiophores with several annellations toward the apex (caused by the enteroblastic percurrent elongations) and basally (sub) truncate distoseptate conidia (Fig. 1). These characters (Figs 2, 3) are present in *Sporidesmiella archidendri* Jian Ma & X.G. Zhang, *S. corniformis* L.G. Ma & al., *S. curtiphora* Carmo & al., *S. guangdongensis* Jian Ma, *S. jiangxiensis* Jian Ma, *S. jiulianshanensis* Jian Ma, *S. lushanensis* Jian Ma, *S. machili* Jian Ma & X.G. Zhang, *S. nanlingensis* Jian Ma & X.G. Zhang, and

Fig. 2. *Sporidesmiella* spp., conidiogenous cells and conidia: A. ***S. archidendri*** (Ma & al. 2012); B. ***S. corniformis*** (Ai & al. 2019); C. ***S. curtiphora*** (Monteiro & al. 2014); D. ***S. guangdongensis*** (Ma 2016a); E. ***S. jiangxiensis*** (Ma 2016a); F. ***S. jiulianshanensis*** (Ma 2016b).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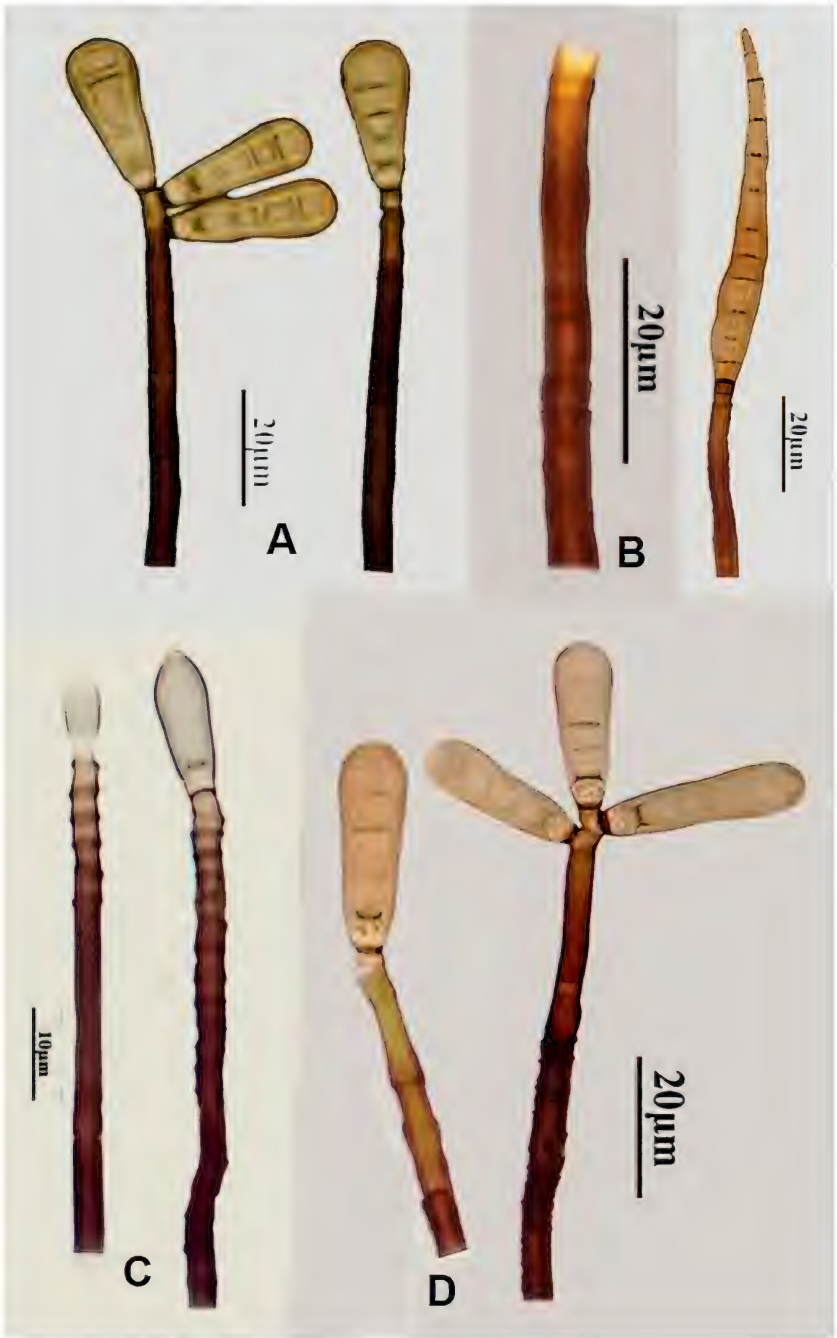
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S. rosae Jian Ma & X.G. Zhang (Ai & al. 2019, Ma 2016a,b, Ma & al. 2012, 2015, Monteiro & al. 2014), but *Sporidesmiella angustobasilaris* (Holubová-Jechová 1987) differs morphologically from all other described *Sporidesmiella* species in its macronematous conidiophores, which are frequently reduced to lageniform determinate conidiogenous cells that lack percurrent extensions and produce distoseptate conidia with attenuated or rounded dark bases.

Here we propose a new genus *Anasporidesmiella*, which contains the new combination *A. angustobasilaris* to accommodate the atypical *Sporidesmiella* species plus a species new to science, *A. manifesta*.

Materials & methods

Samples of litter were placed in paper and plastic bags, taken to the laboratory, and prepared according to Castañeda-Ruiz & al. (2016). Mounts were prepared in PVL (polyvinyl alcohol and lactic acid) and measurements were made at a magnification of ×1000. Micrographs were obtained with a Nikon Eclipse 80i microscope equipped with bright field and Nomarski interference optics. The type specimens are deposited in the Herbarium of Instituto de Ecología A.C., Xalapa, Veracruz, Mexico (XAL).

Taxonomy

Anasporidesmiella K. Zhang, R.F. Castañeda, Heredia & Jian Ma, **gen. nov.**

MB 832848

Differs from *Sporidesmiella* by its lageniform, determinate conidiogenous cells and its distoseptate conidia with attenuate or rounded bases with dark basal scars.

Type species: *Sporidesmiella angustobasilaris* Hol.-Jech. [≡ *Anasporidesmiella angustobasilaris* (Hol.-Jech.) K. Zhang & al.]

Etymology: Greek, *ana-*, meaning upwards + Latin *sporidesmiella* for its similarity to the hyphomycetous genus *Sporidesmiella*.

Conidiophores macronematous, mononematous, unbranched, erect, straight, cylindrical to subulate, frequently reduced to conidiogenous cells, brown to dark brown. Conidiogenous cells monoblastic, integrated, terminal, lageniform, determinate, strongly attenuating toward the conidiogenous loci. Conidial secession schizolytic. Conidia solitary, acrogenous, cylindrical, long ellipsoidal to long oblong distoseptate, brown or dark brown, smooth-walled, bases tapered and truncate or rounded with a slightly melanized or dark basal scar.

Fig. 3. *Sporidesmiella* spp., conidiogenous cells and conidia: A. ***S. lushanensis*** (Ma 2016b); B. ***S. machili*** (Ma & al. 2012); C. ***S. nanlingensis*** (Ma & al. 2015); D. ***S. rosae*** (Ma & al. 2012).

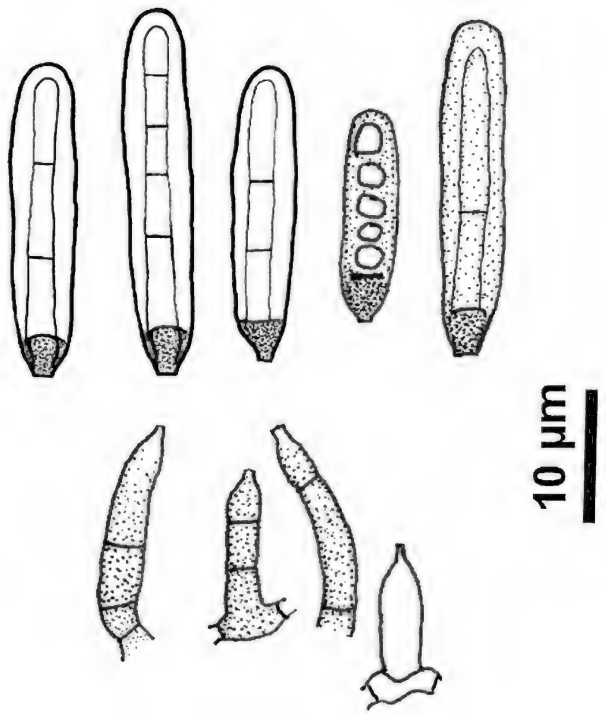

Fig. 4. *Anasporidesmiella angustobasilaris* (adapted from Holubová-Jechová 1987: Fig. 2.3). Conidiophores, conidiogenous cells, and conidia.

Anasporidesmiella angustobasilaris (Hol.-Jech.) K. Zhang, R.F. Castañeda, Heredia & Jian Ma, **comb. nov.** Fig. 4

MB 832849

≡ *Sporidesmiella angustobasilaris* Hol.-Jech, Česká Mykol. 41(1): 35 (1987).

Anasporidesmiella manifesta Heredia, J. Delgado, K. Zhang, R.F. Castañeda, & Jian Ma, **sp. nov.** Figs 5, 6

MB 832850

Type: Mexico, Mexico State, San José Huiloteapan, Huixquilucan, 19°23′N 99°20′W, on decaying wood of an unidentified tree, 29 October 2018, J.P. Delgado (**Holotype**, XAL cb2303).

Differs from *Anasporidesmiella angustobasilaris* by its 7–12-distoseptate conidia with rounded bases.

Etymology: Latin, *manifesta-*, meaning evident, clear, manifest.

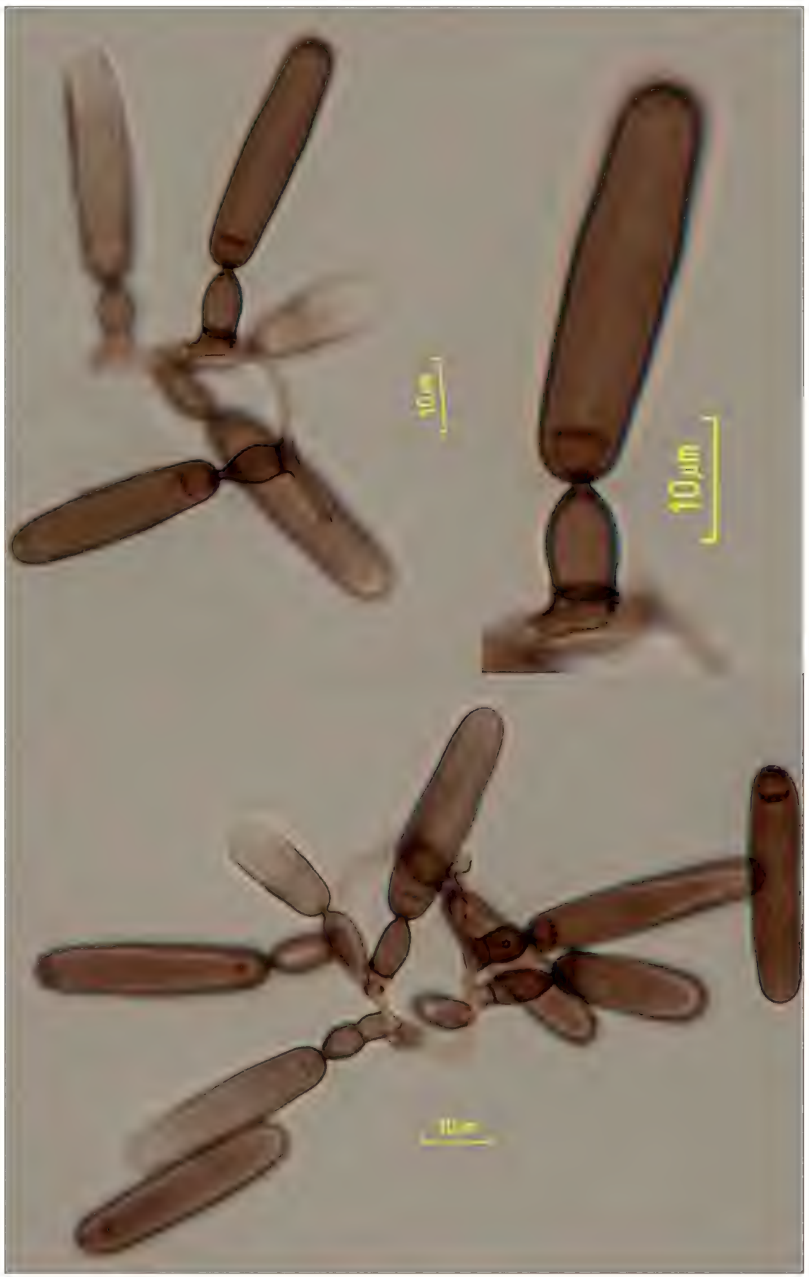

Fig. 5. *Anasporidesmiella manifesta* (ex holotype, XAL cb2303).
Hyphae, conidiophores, conidiogenous cells, and conidia.

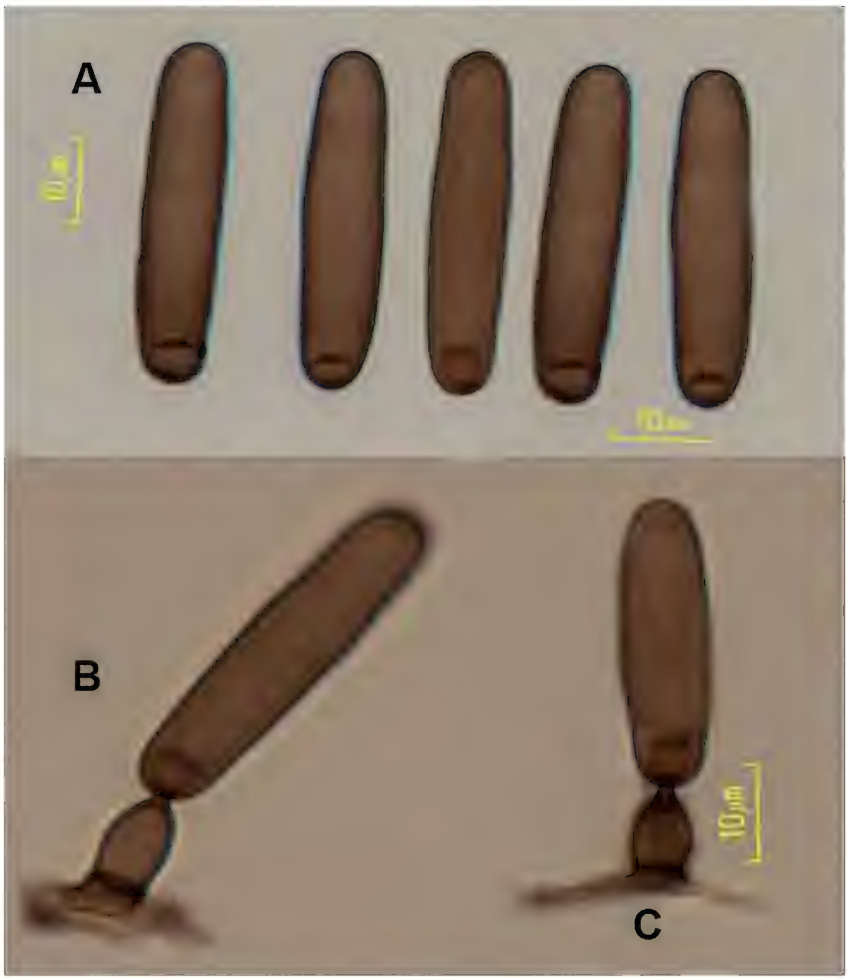

Fig. 6. *Anasporidesmiella manifesta* (ex holotype, XAL cb2303).
A. Conidia. B, C. Conidiogenous cells and conidia.

Colonies on the natural substrate effuse, funiculose, brown. Mycelium mostly superficial, composed of branched, septate, smooth-walled, pale brown to brown hyphae, 1–2 μm diam. Conidiophores macronematous, mononematous, unbranched, erect, straight, cylindrical to subulate, strongly attenuate at the apex, 1–2-septate, mostly reduced to conidiogenous cells, smooth-walled, brown to dark brown, 8–20 × 2–4 μm. Conidiogenous cells monoblastic, lageniform, strongly attenuating toward the conidiogenous loci,

integrated, terminal, determinate, smooth-walled, brown, 5–11 × 4–5 µm. Conidial secession schizolytic. Conidia solitary, acrogenous, cylindrical to long oblong, rounded at the ends, 7–12-distoseptate, brown or dark brown, smooth-walled, with a slightly melanized basal scar, 28–49 × 6–9 µm.

Note: *Anasporidesmiella manifesta* conidia resemble those of *A. angustobasilaris* in size (24–44 × 6.5–10 µm) and cylindrical shape, but *A. angustobasilaris* produces conidia that are 3–10-distoseptate, attenuated and truncate at the base and rounded at the apex (Holubová-Jechová 1987). The illustrations provided for *A. angustobasilaris* in the original publication do not show any enteroblastic percurrent extension or annellate conidiogenous cells (Fig. 4), although its protologue described the conidiogenous cells as lageniform and "percurrently proliferating" (Holubová-Jechová 1987).

Acknowledgments

This work was financed by the National Natural Science Foundation Program of PR China (31870016). The authors express their sincere gratitude to Dr. Josiane S. Monteiro and Dr. De-Wei Li for their critical review of the manuscript. We acknowledge the facilities provided by Dr. P.M. Kirk and Dr. K. Bensch through the Index Fungorum and MycoBank websites, respectively. Dr. Lorelei Norvell's editorial review and Dr. Shaun Pennycook's nomenclature review are greatly appreciated.

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Critical revision of some myxomycetes in the Argentinian herbaria BAFC and LIL – 5

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Abstract—Sixty-two collections conserved in the herbaria BAFC and LIL are revised herein. Of the 31 different myxomycete species represented, seven are new records for Argentina. These are *Arcyria affinis*, *Badhamia gigantospora*, *Cribraria purpurea*, *Fuligo intermedia*, *Physarum carneum*, *Physarum javanicum*, and *Physarum penetrale*. The LM and SEM micrographs included illustrate the most representative characters of each species.

Key words—*Amoebozoa,* myxobiota, *Myxogastria*, slime moulds, taxonomy

Introduction

This paper continues the revision of the myxomycete specimens collected mostly in Argentinian territory and deposited in the international herbaria BAFC and LIL. Moreno & al. (2012, 2013a, b, 2015) previously published four papers in this series. The first paper (Moreno & al. 2013a) covered 32 specimens representing 20 taxa deposited in the BAFC herbarium, which preserves 476 myxomycete collections. Moreno & al. (2012) considered 25 specimens representing 15 species, ten of which were deposited in LIL, which

houses 550 myxomycete specimens. Moreno & al. (2013b) next identified 29 species represented by 86 specimens, 41 of which were deposited in AH and 45 in BAFC. Most recently, Moreno & al. (2015) reported 57 specimens representing 26 myxomycete species preserved in BAFC, BA, LIL, and AH.

Materials & methods

The material studied is preserved in the herbarium of the School of Exact and Natural Sciences, University of Buenos Aires, Argentina (BAFC) and the herbarium of the Miguel Lillo Foundation, Tucumán, Argentina (LIL).

The original determination is indicated in square brackets in the SPECIMEN(S) EXAMINED section, and the absence of brackets indicates that the specimen had not been determined previously. Revision labels deposited along with the specimens indicate that Eva García Carvajal reviewed a large part of the BAFC collection in 2010, and thus we also cite original determinations, revised determinations, and the reviser's name.

New records for Argentina are marked with an asterisk (*).

The slides mounted in Hoyer's medium for each specimen are preserved in the herbarium of the Universidad de Alcalá, Alcalá de Henares, Madrid, Spain (AH). Spore measurements were made using an oil immersion objective and include surface structures as warts and spines.

Scanning electron microscopy (SEM) micrographs were obtained at the Universidad de Alcalá using a Zeiss DSM-950. For ultramicroscopic studies, one sporocarp was placed on a 2 × 2 cm square of Whatman filter paper no. 1; the paper was folded into a packet to prevent the loss of spores and stapled shut, after which the packeted specimen was rehydrated in concentrated ammonium hydroxide (28–30%) for 30 minutes, dehydrated in aqueous ethanol (70%) for 30 minutes, fixed for two hours in pure ethylene glycol dimethyl ether (= 1,2-dimethoxymethane), immersed in pure acetone for at least two hours, and finally critically point dried and sputtered with gold-palladium. This technique uses very little material (a portion of a single sporocarp or no more than a few spores).

Taxonomy

* ***Arcyria affinis*** Rostaf., Sluzowkce Monogr.: 276. 1875.

LIL 152925 contains scant material. In LIL 152952 the capillitium shows the typical rings, half-rings, and cogs, but we also noted small warts and wider areas on the capillitium. Spores 7–8(–9) µm in diam., nearly smooth, with some evident warts.

SPECIMENS EXAMINED: **ARGENTINA, TUCUMAN, Chicligasta**, Los Alisos National Park, 867 m, on wood of "laurel del cerro" *Ocotea porphyria* (Griseb.) van der Werff, 18-V-2015, leg. P. Medina & A. Hladki 698 (LIL 152925); **Tafí**, el Rincón, provincial route 325, 2300 m, 4-IV-2014, leg. C. Izarduy & A. Hladki 5034 (LIL 152952).

Remarks—The capillitial ornamentation of our specimens of *Arcyria affinis* is similar to what was drawn by Nannenga-Bremekamp (1991). A detailed study under SEM of the species was done by Moreno & al. (2018).

Arcyria affinis is a new record for Argentina.

Badhamia affinis Rostaf., Sluzowkce Monogr.: 143. 1874.

Specimen examined: **ARGENTINA, Buenos Aires, Llavallol,** Santa Catalina, Instituto Fitotécnico, 24–XII–1969, leg. J.R. Deschamps [as *Physarum notabile*, rev. Eva García Carvajal as *Badhamia affinis*] (BAFC 22242).

Remarks—Nannenga-Bremekamp (1991) observed that *Badhamia affinis* was characterized by a badhamioid capillitium with roughly parallel and slightly anastomosed calcium carbonate threads. A SEM study of the spore ornamentation of this species was carried out by Moreno & al. (2013a).

Badhamia affinis was cited as occurring in Argentina for the first time by Deschamps (1976b).

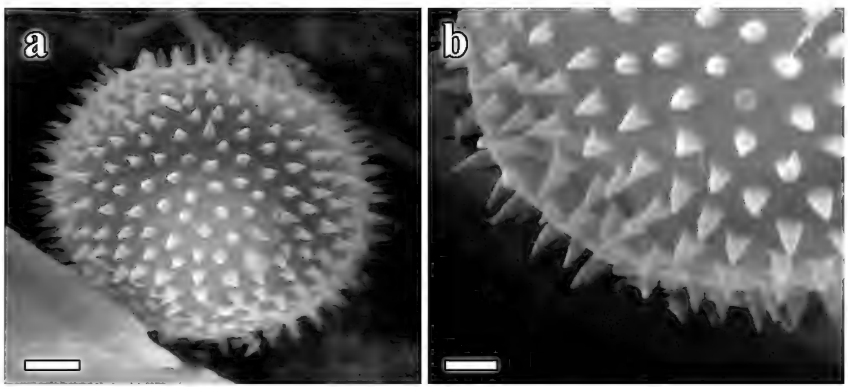

Fig. 1 ***Badhamia gigantospora*** (BAFC 51240):
a. Spiny spore; b. Detail of the spore ornamentation. Scale bars: a = 2 µm; b = 1 µm.

****Badhamia gigantospora*** Ukkola & Härk., Karstenia 36(1): 43. 1996. Fig. 1

BAFC 51240 consists of two boxes containing glued pieces of wood along with a plastic envelope with abundant spores. The collection contains a dozen sporocarps, very mature, so they had lost part of the peridium and capillitium. Stalk cylindrical, widened at the base, pale reddish-brown, about 2 mm high. Sporotheca umbilicate at the base. Capillitium badhamioid, formed by roughly parallel filaments, mostly broken. Spores 13–16 µm in diam., dark violaceous-brown, with remarkable spines. Under SEM the

ornamentation was confirmed as bearing approx. 1 µm long spines, which Rammeloo (1975) described as the echinate type.

Specimen examined: **ARGENTINA, Buenos Aires, Chascomús,** campo "La Alameda", on pieces of wood possibly from a member of the *Palmaceae*, 27–III–2002, leg. Sannazzaro & E. Albertó [as *Physarum pezizoides*, rev. Eva García Carvajal as *Physarum pezizoideum* var. *pezizoideum*] (BAFC 51240).

Remarks—The aforementioned characters place our specimen close to *Badhamia gigantospora,* a species described by Ukkola & Härkonen (1996) from material collected in Africa (Tanzania, Liberia) on the woody debris of *Cupressus lusitanica* Mill. According to the protologue, the species is characterized by large (18–22 µm diam.), dark brown, and very spiny spores (spines approx. 2 µm long). Our Argentinian specimen differs in its smaller (13–16 µm diam.) spores, measurements that fit with those indicated by Lado & al. (2017) for specimens collected in Yasuní (Ecuador) and also identified as *Badhamia gigantospora.*

Badhamia gigantospora is a new record for Argentina.

Craterium leucocephalum (Pers. ex J.F. Gmel.) Ditmar,
Deutschl. Fl. Pilze 1(1): 21. 1813. Fig. 2

BAFC 22492 contains abundant sporocarps that are characterized by the whitish, cylindrical columella (not always well developed in mature specimens) and abundant, small, white, subglobose to slightly elongated capillitial nodes. Stalk short, straw colored. Peridium very thin, simple, whitish, easily and irregularly broken. Under SEM, the spore ornamentation consists of short bacula (<0.5 µm long), described by Rammeloo (1974) as the baculate type.

Specimen examined: **ARGENTINA, Buenos Aires, Llavallol,** Santa Catalina, Instituto Fitotécnico, 25–V–1972, leg. R. Vicari [as *Physarum mutabile*, rev. Eva García Carvajal as *P. mutabile*] (BAFC 22492).

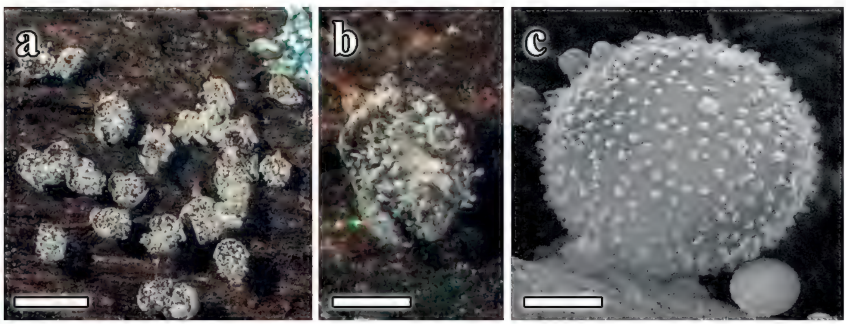

Fig. 2. ***Craterium leucocephalum*** (BAFC 22492): a. Sporocarps; b. Detail of the columella; c. Spore. Scale bars: a = 1 mm; b = 0.5 mm; c = 2 µm.

Remarks—*Craterium leucocephalum* could be confused with *Physarum mutabile* (Rostaf.) G. Lister, which differs in its scanty capillitium nodes, very short stalk, and spinose spores.

The macrographs of our specimen resemble those obtained by Moreno & Oltra (2010).

Craterium leucocephalum is a cosmopolitan species (Martin & Alexopoulos 1969), previously cited as occurring in Argentina by Deschamps (1976b) and Crespo & Lugo (2003).

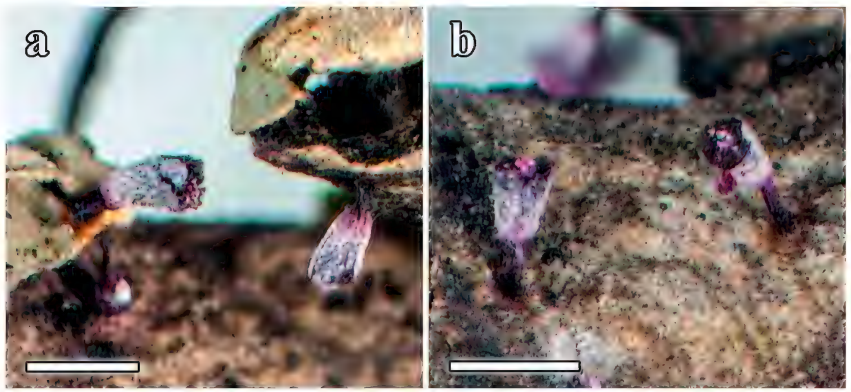

Fig. 3. ***Craterium paraguayense*** (LIL 152953):
a. Sporocarps; b. Sporocarps and pseudocolumella. Scale bars = 1 mm.

Craterium paraguayense (Speg.) G. Lister,
Monogr. Mycetozoa, ed. 2: 95. 1911. Fig. 3

LIL 152953 is associated with twigs and bryophytes. Peridium white-violaceous outside, dark violet inside. Pseudocolumella cylindrical, dark violet, with thick warts.

Specimen examined: **ARGENTINA, Salta, General José de San Martín**, Reserva Provincial Acambuco, 867 m, 21–V–2015, leg. P. Medina & A. Hladki 691 (LIL 152953).

Remarks—Spegazzini (1886) described *Craterium paraguayense* from Guarapí (Paraguay), where it occurred on dead leaves of *Luehea grandiflora* Mart. Castillo & al. (2002), who studied the holotype, noted that *C. paraguayense* can be distinguished macroscopically from other *Craterium* species by the violet shades of its cylindrical sporotheca, its violaceous blackish stalk, and 7–9 μm diam. spores—all characters observed in our collection.

Craterium paraguayense was first cited as occurring in Argentina by Arambarri (1975).

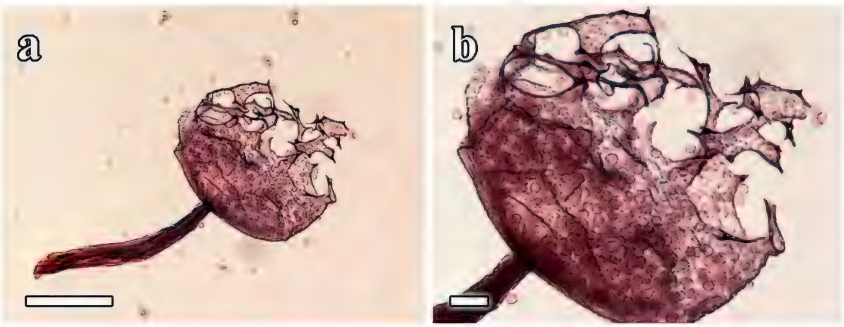

Fig. 4. ***Cribraria purpurea*** (LIL 15294):
a. Sporocarp; b. Detail of the sporotheca. Scale bars: a = 500 µm; b = 100 µm.

* ***Cribraria purpurea*** Schrad., Nov. Gen. Pl.: 8. 1797. Fig. 4

LIL 152954 comprises sporocarps 0.3–0.5 mm high. Sporotheca approx. 0.2 mm diam., dark violet to purple-violet, the basal half completely joining to form a cup and the upper part broken into thick and irregular plates linked by filaments. Stalk short, equal or slightly higher than the sporotheca, cylindrical, blackish. Capillitium absent. Dictydine granules violet. Spores pale violaceous, with warts.

Specimen examined: **ARGENTINA**, **Tucumán, Tafí,** el Rincón, provincial route 325, 2300 m, in ravine with alders (*Alnus acuminata* Kunth), 4–IV–2014, leg. C. Izarduy & A. Hladki 5038 (LIL 152954; with *Physarum robustum*).

Remarks—*Cribraria purpurea* represents a new record for Argentina (https://discoverlife.org). In South America, this species was reported previously as occurring in Venezuela (Lado & al. 2008).

Diachea leucopodia (Bull.) Rostaf., Sluzowkce Monogr.: 190. 1874.

LIL 152956 is slightly sclerotized.

Specimens examined: **ARGENTINA**, **Salta, General José de San Martín,** Reserva Provincial Acambuco, 867 m, 21–V–2015, leg. P. Medina & A. Hladki 690 (LIL 152955); **Tucumán, Tafí,** las Carreras, south of the viewpoint of the Condor, provincial route 325, 2367 m, on bark, 4–IV–2014, leg. C. Izarduy & A. Hladki 5032 (LIL 152956); el Rincón, provincial route 325, 2300 m, in ravine with alders (*Alnus acuminata*), 4–IV–2014, leg. C. Izarduy & A. Hladki 5042 (LIL 153063).

Remarks—*Diachea leucopodia* is a cosmopolitan species that usually produces numerous sporocarps, typically on herbaceous plant debris (Martin & Alexopoulos 1969).

Deschamps (1976a) and Crespo & Lugo (2003) reported *D. leucopodia* for Argentina.

Didymium difforme (Pers.) Gray, Nat. Arr. Brit. Pl. 1: 571. 1821.

The spores of LIL 153113 are 12–14 µm in diam. with a paler zone and very faint warts.

Specimen examined: **ARGENTINA**, **Tucumán, Tafí,** el Rincón, provincial route 325, 26°57′40″S 65°46′34″W, 2300 m, in ravine with alders (*Alnus acuminata*), 4–IV–2014, leg. C. Izarduy & A. Hladki 5043 (LIL 153113).

Remarks—Lizárraga & al (1998), who studied Mexican specimens of *Didymium difforme* under SEM, demonstrated that the warts of this species join to form a subtle reticulum.

Deschamps (1976b) and Crespo & Lugo (2003) previously reported *D. difforme* for Argentina.

Didymium nigripes (Link) Fr., Syst. Mycol. 3: 119. 1829.

BAFC 31015 comprises abundant sporocarps with blackish colored stalks and pseudocolumellas. Peridium hyaline, with brown areolae, covered with stellate calcium carbonate crystals. Stalk longer than the sporothecal diameter, translucent reddish-brown without granules. Spores 9–10 µm in diam., pale violaceous-brown, verrucose with groups of warts.

Specimen examined: **ARGENTINA**, **Misiones, Iguazú,** ruta nac. 12, km. 20, SE harbour Iguazú, on *Psychotria myriantha* Müll. Arg., leg. S. Ferrucci nº 473, det. J.E. Wright [as *Physarum* aff. *pusillum* ex CTES, rev. Eva García Carvajal as *Didymium nigripes*] (BAFC 31015).

Remarks—Deschamps (1976b) and Crespo & Lugo (2003) previously reported *Didymium nigripes* for Argentina.

Didymium squamulosum (Alb. & Schwein.) Fr., Symb. Gasteromyc. 3: 19. 1818.

Most of the specimens have the typical whitish pseudocolumella but in LIL 153177 and LIL 153176 the color of this structure varied from orange to brown-orange. The collection BAFC 22563 contained three boxes—two small boxes with *Didymium squamulosum* and a large one with *Physarum album.*

Specimens examined: **ARGENTINA**, **Buenos Aires, Llavallol,** Santa Catalina, Instituto Fitotécnico, leaf litter of *Ulmus procera*, 9–II–1972, leg. M. Adler [as *Physarum nutans*, rev. Eva García Carvajal as *Didymium squamulosum* with *Physarum* aff. *nutans*] (BAFC 22563; with *Physarum album*); **Tucumán, Chicligasta,** National Park los Alisos, 27°17′30″S 64°51′30″W, 867 m, bay leaf, 18–V–2015, leg. P. Medina & A. Hladki 697 (LIL 153176); **Juan Bautista Alberdi,** dique Escaba, 27°43′37″S

65°47′49″W, 828 m, bay leaf, 8–VI–2015, leg. P. Medina & A. Hladki 692 (LIL 153177); **Tafí**, el Rincón, provincial route 325, 26°57′40″S 65°46′34″W, 2300 m, on twigs and herbaceous debris, 4–IV–2014, leg. C. Izarduy & A. Hladki 5035 [as *Physarum* sp.] (LIL 153178).

Remarks—*Didymium squamulosum* is a cosmopolitan species (Martin & Alexopoulos 1969) that fruits mainly on the debris from herbaceous plants and the leaves of trees. Deschamps (1976b) and Crespo & Lugo (2003) previously reported *D. squamulosum* for Argentina.

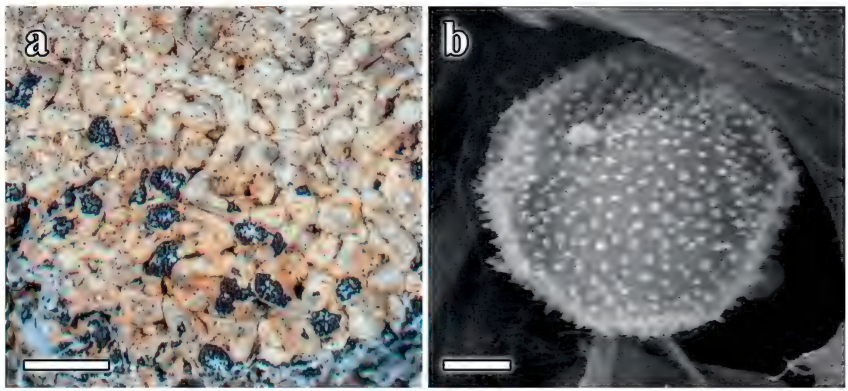

Fig. 5. ***Fuligo intermedia*** (BAFC 22496):
a. Detail of the aethalium; b. Spore. Scale bars: a = 1 mm; b = 2 µm.

* ***Fuligo intermedia*** T. Macbr., N. Amer. Slime-moulds, ed. 2: 30. 1922. Fig. 5

Under SEM, the spore ornamentation of the specimen consists of short (<0.5 µm long) bacula, classified by Rammeloo (1975) as the pileate type.

Specimen examined: **ARGENTINA, Buenos Aires, Ezeiza**, on bark of *Populus nigra* L., 12–III–1972, leg. J.R. Deschamps & G. Rovetta [as *Physarum contextum*, rev. Eva García Carvajal as *Fuligo intermedia*] (BAFC 22496).

Remarks—*Fuligo intermedia* is a distinctive species. Lizárraga & al. (2015) described it as an aethalium in which the remains of individual sporocarps can be seen only at the apical part and having large (10–12 µm diam) spores. These characters agree with our specimen. Lizárraga & al. (2015) also noted that the larger spore size helps distinguish *F. intermedia* from *F. septica* (with 6–9 µm diam spores).

Fuligo intermedia is common in North and Central America, but BAFC 22496 is the first collection from South America, making it a new record for both Argentina and the rest of South America (http://discoverlife.org).

Hemitrichia parviverrucospora (Lizárraga, Illana & G. Moreno) G. Moreno & Illana, Mycotaxon 77: 187. 2001. FIG. 6

LIL 153179 exhibits perfectly the complex spore ornamentation typical of this species. The ornamentation consists of a raised wall reticulum that forms a wide mesh with walls sometimes divided to create smaller, independent meshes. The reticulum "valleys" are covered with small (<0.1 µm long) warts that sometimes join in short crests, representative of the cristate reticulate type described by Rammeloo (1974).

SPECIMEN EXAMINED: **ARGENTINA**, **TUCUMÁN**, **Chicligasta,** National Park los Alisos, 27°17′30″S 64°51′30″W, 867 m, on wood debris, 18–V–2015, leg. P. Medina & A. Hladki 695 (LIL 153179).

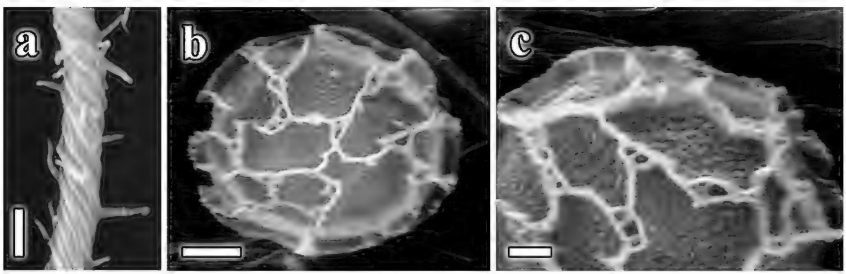

FIG. 6. ***Hemitrichia parviverrucospora*** (LIL 153179):
a. Spiny elater; b. Spore; c. Detail of the spore ornamentation.
Scale bars: a = 5 µm; b = 2 µm; c = 1 µm.

REMARKS—*Hemitrichia parviverrucospora,* originally described from Mexico as a variety of *H. serpula* by Lizárraga & al. (1999), was elevated to species by Pérez-Silva & al. (2001).

Hemitrichia parviverrucospora was analyzed molecularly out by Dagamac & al. (2017). Moreno & al. (2012; 2013b; 2015) reported the species from Salta and Tucumán (Argentina).

Mucilago crustacea F.H. Wigg., Prim. Fl. Holsat.: 112. 1780.

SPECIMEN EXAMINED: **ARGENTINA**, **BUENOS AIRES, Ezeiza**, on wood of *Populus nigra* var. *italica* Münchh., 28–IV–1972, leg. J.R. Deschamps & G. Rovetta [as *Physarum didermoides*] (BAFC 22853; with *Physarum didermoides*).

REMARKS—Despite *Mucilago crustacea* being cited as cosmopolitan by Martin & Alexopoulos (1969), it has been cited as occurring in Argentina only once previously, by Spegazzini (1926).

Physarella oblonga (Berk. & M.A. Curtis) Morgan,
J. Cincinnati Soc. Nat. Hist. 19(1): 7. 1896.

The peridium and spikes inside the sporotheca are yellow in specimens BAFC 22825 and BAFC 22215 (typical for *P. oblonga*). However, in BAFC 22210, a collection obtained in a moist chamber culture, both the spikes and the peridium are white.

Specimens examined: **ARGENTINA**, **Buenos Aires, Ezeiza**, on bark of *Populus nigra*, IV–1972, leg. J.R. Deschamps, G. Rovetta & Vicari, [as *Physarella oblonga*] (BAFC 22825); **Santa Catalina**, Instituto Fitotécnico, in a moist chamber culture, sector A1, 1–XI–1969, leg. L. Veltri & L. Frias [*as Physarella oblonga*] (BAFC 22210); **Longchamps**, 9–III–1969, leg. M. Adler [as *Physarella oblonga*] (BAFC 22215).

Remarks—Excellent photographs of *Physarella oblonga* were published by Poulain & al. (2011). Crespo & Lugo (2003) cited *P. oblonga* as widely distributed in Argentina.

Physarum album (Bull.) Chevall., Fl. Gén. Env. Paris 1: 336. 1826.

BAFC 22235, which lacks any entire sporocarps, could represent either *Physarum album* or *Physarum javanicum;* we decided to follow the original identification (*Physarum album*).

BAFC 22563 consists of three boxes—two small (containing *Didymium squamulosum*) and a large one with *Physarum album* comprising numerous sporocarps on dry leaves. The whitish sporocarps have a lenticular sporotheca, umbilicate base, and occasional petaloid dehiscence. Capillitium reticulate, with few whitish and fusiform nodes. Spores 10–11 µm diam., violaceous-brown, faintly verrucose with warts in groups.

Specimens examined: **USA, New York,** Clyde, VIII–1889, leg. O.F. Cook, on wood debris [as *Physarum nutans*] (The National Fungus Collection 40, in BAFC 26539); **ARGENTINA, Buenos Aires, Llavallol,** Santa Catalina, 15–VI–1969, on wood debris, leg. J.R. Deschamps [as *Physarum nutans*, rev. Eva García Carvajal as *Ph. nutans*] (BAFC 22235); on leaf litter of *Ulmus procera*, 9–II–1972, leg. M. Adler [as *Physarum nutans*, rev. Eva García Carvajal as *Physarum* aff. *nutans* with *Didymium squamulosum*] (BAFC 22563; with *Didymium squamulosum*).

Remarks—*Physarum album*, a cosmopolitan species (Martin & Alexopoulos 1969), was previously cited as occurring in Argentina by Crespo & Lugo (2003).

Physarum bivalve Pers., Ann. Bot. (Usteri) 15: 5. 1795. Fig. 7

BAFC 30408 and BAFC 30409 (collected in New York in 1888 and 1889) are kept in tiny boxes with numerous perfectly conserved plasmodiocarps. The faintly warted spores of BAFC 30408 are 9–10 µm in diam.

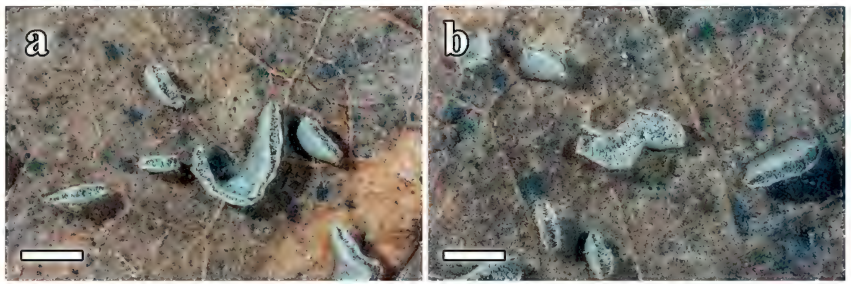

Fig. 7 ***Physarum bivalve*** (BAFC 30408):
a. Detail of the sporocarps; b. Capillitium nodes. Scale bars = 1 mm.

Specimens examined: **USA, New York,** V–1888, on leaves, leg. O.F. Cook 665 [as *Physarum bivalve*] (BPI 3754 in BAFC 30408); Jamesville, on leaves, VII–1889, leg. O.F. Cook 298 [as *Physarum bivalve*] (BPI 3753 in BAFC 30409).

Remarks—*Physarum bivalve* could be confused with *Physarum loratum* Shuang L. Chen & al. (Chen & al. 1999), which differs in its apical and well-developed line of dehiscence and larger (10.4–11.7 µm diam.) spores.

Physarum bivalve was cited as occurring in North America by Martin & Alexopoulos (1969).

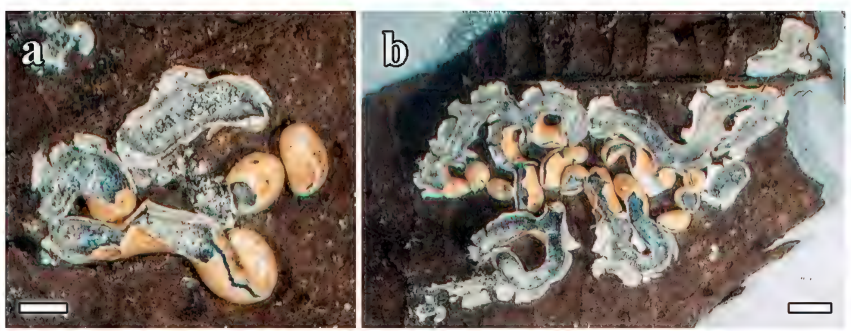

Fig. 8 ***Physarum bogoriense*** (LIL 153180):
a, b. Sporocarps and capillitium nodes. Scale bars = 1 mm.

Physarum bogoriense Racib., Hedwigia 37(1): 52. 1898. Fig. 8

Specimen examined: **ARGENTINA, Tucumán, Tafí,** el Potrerillo, 26°57′31″S 65°43′34″W, 2167 m, in ravine, on birch leaf, 5–IV–2014, leg. C. Izarduy & A. Hladki 5040 (LIL 153180).

Remarks—*Physarum bogoriense* share microscopically similar spores and calcareous nodes with *P. hongkongense* Chao H. Chung. Macroscopically, *P. bogoriense* sporocarps vary from plasmodiocarpous to sporangiate forms

that are not compressed laterally and bear an apical dehiscence. The peridial dehiscence leaves a revolute, petaloid structure. In contrast, *P. hongkongense* plasmodiocarps are compressed laterally and the edges of the peridial dehiscence are clean cut, neither revolute nor petaloid.

Deschamps (1976b) cited one occurrence of *Physarum bogoriense* for Argentina.

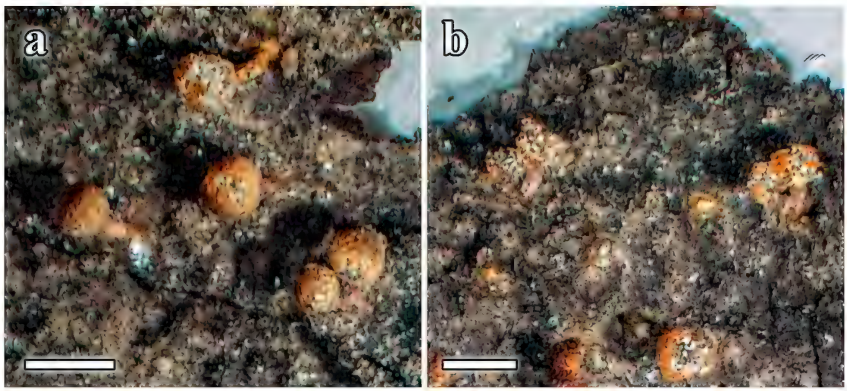

Fig. 9 ***Physarum carneum*** (LIL 153181):
a. Sporocarps; b. Capillitium nodes. Scale bars = 1 mm.

* ***Physarum carneum*** G. Lister & Sturgis, J. Bot. 48: 73. 1910. Fig. 9

LIL 153181 consists of stalked sporocarps, 1–1.5 mm tall overall. Sporotheca globose to subglobose, 0.4–0.8 mm diam. Stalk wide, cylindrical, as tall as the sporotheca, concolorous with the peridium, sometimes with lilac shades. Hypothallus orange-brown and membranous. Peridium simple, orange-brown to pinkish-brown, with granules, breaking apart in an irregular and tessellated manner. Capillitium physaroid with large white nodes, rounded to shortly elongated, linked by hyaline filaments. Pseudocolumella absent. Spores 8.5–10 µm diam., violaceous-brown, verrucose.

Specimens examined: **ARGENTINA**, **Tucumán**, Tafí, el Potrerillo, 26°57′31″S 65°43′34″W, 2167 m, on wood debris, 5–IV–2014, leg. C. Izarduy & A. Hladki 5044 (LIL 153181).

Remarks—*Physarum carneum* has been rarely collected in North America according to Martin & Alexopoulos (1969), and we have not found any records from South America in the literature. Therefore, our specimen is a new record for Argentina and South America.

Physarum cinereum (Batsch) Pers., Neues Mag. Bot. 1: 89. 1794.

BAFC 22239 consists of a glass Petri dish with an evident plasmodium track and a few sporocarps. BAFC 22871 has abundant but broken sporocarps that retain only a few spores and scant capillitium. The remaining collections (BAFC 22857, BAFC 22844, BAFC 22236) contain abundant and well-developed and preserved sporocarps. These collections well illustrate the wide variation from sporangiate to plasmodiocarpous forms and the typical capillitium with small nodes.

Specimens examined: **ARGENTINA**, **Buenos Aires, Lanús**, over the grass, X–1968, leg. L. del Busto, in petri dish [as *Physarum cinereum*] (BAFC 22239); **Llavallol**, Santa Catalina, on bark of *Ulmus procera* in a moist chamber culture, 3–XI–1968, leg. J.E. Wright & J.R. Deschamps [as *Physarum cinereum*] (BAFC 22236); Instituto Fitotécnico, 21–V–1972, on twigs, leg. J.R. Deschamps, G. Rovetta & Vicari [as *Physarum cinereum*] (BAFC 22844); on twigs and leaves, 21–V–1972, leg. J.R. Deschamps & G. Rovetta [as *Physarum cinereum*] (BAFC 22871); **Malaver,** on *Poaceae*, 24–III–1973, leg. A. Méndez [as *Physarum cinereum*] (BAFC 22857).

Remarks—*Physarum cinereum* is a cosmopolitan species (Martin & Alexopoulos 1969), cited as occurring in Argentina by Deschamps (1976b) and Crespo & Lugo (2003).

Physarum compressum Alb. & Schwein., Consp. Fung. Lusat.: 97. 1805.

The spores of our five specimens are 10–12 µm diam.

Specimens examined: **ARGENTINA**, **Buenos Aires, Capital Federal**, on dead trunk of *Melilotus officinalis*, 9–VII–1940, leg. A. Burkart [as *Physarum compressum*, rev. Eva García Carvajal as *P. compressum*] (BAFC 22490); **Laguna Vitel**, on *Palmaceae*, 11–X–1968, leg. J.R. Deschamps [as *Physarum compressum*, rev. Eva García Carvajal as *P. compressum*] (BAFC 22228); **Llavallol,** Santa Catalina, Instituto Fitotécnico, on spathe de *Palmaceae*, 16–IV–1972, leg. J.R. Deschamps & G. Rovetta [as *Physarum compressum*, rev. Eva García Carvajal as *Ph. compressum*] (BAFC 22867); **Longchamps**, plant debris, 10–X–1968, leg. M. Adler [as *Physarum compressum*] (BAFC 22139 with *Didymium bahiense)*; **Misiones, Iguazú,** ruta nac. 12, km. 30, SE harbour Iguazú, on bark of *Nectandra saligna*, in mixed forest of *Aspidosperma polyneuron*, 28–X–1973, leg. J.E. Wright, J.R. Deschamps & I. del Busto [as *Physarum compressum*] (BAFC 23195).

Remarks—Our spore measurements for *Physarum compressum* match those cited by Martin & Alexopoulos (1969). However, Nannenga-Bremekamp (1991) cited larger (12–14 µm diam.), while Poulain & al. (2011) reported spores measuring 11–15 µm in one collection and 9.5–11.5 µm in a different one.

Crespo & Lugo (2003) reported *P. compressum* as frequent in Argentina.

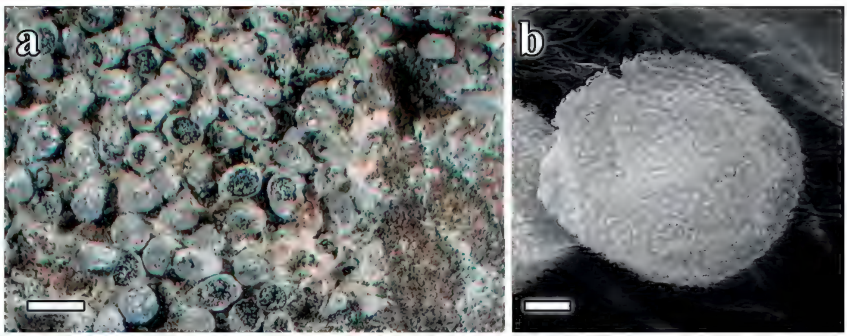

FIG. 10 ***Physarum didermoides*** (BAFC 22839): a. Sporocarps; b. Spore. Scale bars: a = 1 mm; b = 2 μm.

Physarum didermoides (Pers.) Rostaf., Sluzowce Monogr. 97. 1874. FIG. 10

BAFC 22549 displays the typical easily breaking exoperidium and cylindric sporocarps with a slimy, white yellowish hypothallus. Pseudocolumella whitish and elongated. Spores 13–15 μm in diam., strongly verrucose. Most of the spores in BAFC 22602 and BAFC 22267 are collapsed, thus exhibiting marks that give them an atypical polygonal shape.

Under SEM, the spore ornamentation consists of <0.5 μm long warts joined into short crests of 2–3–4 warts, classified by Rammeloo (1975) as the verrucate type.

SPECIMENS EXAMINED: **ARGENTINA, BUENOS AIRES, Capital Federal**, Saavedra park, on bark of *Morus alba*, IV–1972, leg. J.R. Deschamps & J.E. Wright [as *Physarum didermoides*, rev. Eva García Carvajal as *P. didermoides*] (BAFC 22870); **Ezeiza**, leg. Falcone [as *Physarum didermoides*, rev. Eva García Carvajal as *P. didermoides* cf.] (BAFC 22549); on wood, 14–IV–1971, leg. Vinka Kohn [as *Physarum didermoides*] (BAFC 22839); on bark of *Populus nigra*, 12–III–1972, leg. J.R. Deschamps & G. Rovetta [as *Physarum didermoides*] (BAFC 22868); on trunks of *Populus nigra* var. *italica* with *Mucilago crustacea*, 28–IV–1972, leg. J.R. Deschamps & G. Rovetta [as *Physarum didermoides*] (BAFC 22853); **Llavallol,** Santa Catalina, Instituto Fitotécnico, 15–VII–1969, on bark, leg. J.R. Deschamps [as *Physarum didermoides*, rev. Eva García Carvajal as *P. didermoides*] (BAFC 22227); Santa Catalina, 10–X–1969, leg. J.R. Deschamps [as *Physarum didermoides*] (BAFC 22142); Santa Catalina, Instituto Fitotécnico, 3–X–1970, leg. J.R. Deschamps, on bark [as *Physarum didermoides*] (BAFC 22267); **CORRIENTES, Saladas**, Santa Lucía river, on bark, 15–VIII–1972, leg. J.R. Deschamps [as *Physarum didermoides*] (BAFC 22602).

REMARKS—*Physarum didermoides* could be confused with *P. spectabile* Nann.-Bremek. & al., which differs in its succulenticolous habit (occurring mainly on the cladodes of *Opuntia* Mill.), its thin exoperidium, abundant and tiny capillitial nodes, and its polygonal spores (12–13.5 μm diam.).

Crespo & Lugo (2003) reported *P. didermoides* as widely distributed in Argentina.

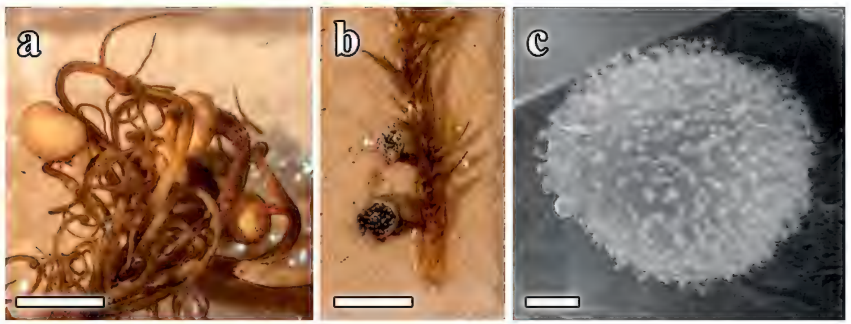

Fig. 11 ***Physarum flavidum*** (BAFC 30410):
a. Sporocarps; b. Capillitium nodes; c. Spore. Scale bars: a, b = 1 mm; c = 2 µm.

Physarum flavidum (Peck) Peck, Annual Rep.
New York State Mus. Nat. Hist. 31: 55. 1879. Fig. 11

BAFC 30410 contains gregarious sporocarps with a globose, yellowish to yellowish-brown sporotheca. Peridium double, fragile, outer layer with granules of calcium carbonate. Stalk short to very short, reddish-orange, translucent. Capillitium with elongated white nodes. Spores 10–12 µm diam, spinulose. Under SEM, the spore ornamentation baculate with coralloid tips.

Specimen examined: **USA, Washington D.C.,** on to bryophytes, leg. M.B. Waite [as *Physarum flavidum*] (BAFC 30410 ex BPI 3796).

Remarks—The Argentinian material of *Physarum flavidum* was collected from similar habitat described by Martin & Alexopoulos (1969)—bryophytes and dead wood. The species, originally described from the United States, is widely distributed on both coasts of North America (https://discoverlife.org).

* ***Physarum javanicum*** Racib., Hedwigia 37(1): 53. 1898. Fig. 12

The best-preserved material, BAFC 22535, contains abundant sporocarps with umbilicate sporothecas and very long grey-white stalks, (measuring more than three times the height of the sporotheca). Peridial dehiscence irregular to stellate. Capillitial nodes small and whitish. Spores 8–10 µm diam., pale violaceous-brown, verrucose with groups of darker warts.

LIL 693 consists of flattened sporocarps crushed and stuck to the substrate making the umbilicate sporotheca difficult to observe; the length of the stalks confirms the material as *Physarum javanicum*.

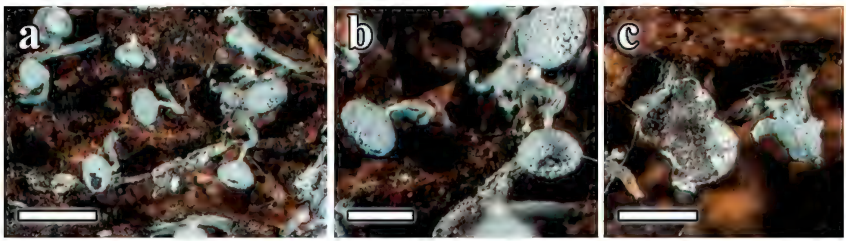

Fig. 12 ***Physarum javanicum*** (BAFC 22535):
a. Sporocarps; b. Detail of the umbilicate sporotheca; c. Whitish capillitium nodes.
Scale Bars: a = 1 mm; b, c = 0.5 mm.

Specimens examined: **ARGENTINA**, **Buenos Aires, Llavallol**, Santa Catalina, Instituto Fitotécnico, 3–IV–1971, leg. Arguijo [as *Physarum nutans*, rev. Eva García Carvajal as *P. nutans*] (BAFC 22535); **Tucumán, Juan Bautista Alberdi**, dique Escaba, 27°43′37″S 65°47′49″W, 828 m, on leaf of "laurel del cerro" (*Ocotea porphyria*), 8–VI–2015, leg. P. Medina & A. Hladki 693 (LIL 153182).

Remarks—The mature, well-developed specimens of *Physarum javanicum* recall the photos in Poulain & al. (2011). According to https://discoverlife.org *Physarum javanicum* was previously cited from South America only in Brazil and French Guyana. Our report represents a new record for Argentina.

Physarum leucophaeum Symb. Gasteromyc. 3: 24. 1818.

Specimen examined: **USA. Oregon, Benton County**, Fall Creek State Fish Hatchery, on moss covered decaying logs, 24–VIII–1962, leg. Lee Bonar, C.T. Rogerson, & M.L. Farr [as *Physarum leucophaeum* and confirmed by Eva García Carvajal] (BPI 3803 in BAFC 30411).

Remarks—*Physarum leucophaeum* was cited as occurring in Argentina by Crespo & Lugo (2003).

* ***Physarum penetrale*** Rex, Proc. Acad. Nat. Sci. Philadelphia 43: 389. 1891. Fig. 13

LIL 153183 contains well-developed sporocarps with a long, cylindrical, orange-brown columella, translucent under transmitted light and without calcium carbonate. Sporotheca wide open, so most spores have been lost. Capillitium with tiny, yellowish nodes. Spores 6.5–7.5 µm diam., pale brown, verrucose with warts in groups.

Specimen examined: **ARGENTINA**, **Tucumán, Chicligasta**, National Park los Alisos, 27°17′30″S 64°51′30″W, 867 m, on wood of *Ocotea porphyria*, 18–V–2015, leg. P. Medina & A. Hladki 696 (LIL 153183; with *Xylaria* sp.).

Remarks—*Physarum penetrale* is a new record for Argentina.

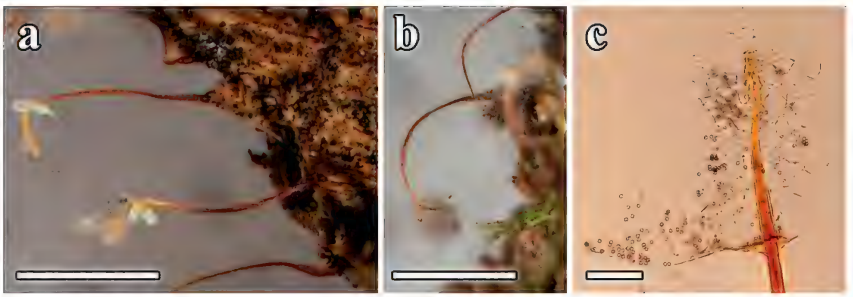

Fig. 13 ***Physarum penetrale*** (LIL 153183):
a. Sporocarps and columella; b. Sporocarp, columella, and capillitium;
c. Detail of columella and capillitium. Scale bars: a, b = 1 mm; c = 100 µm.

Physarum pusillum (Berk. & M.A. Curtis) G. Lister,
Monogr. Mycetozoa, ed. 2: 64. 1911. Fig. 14

BAFC 22279 contains abundant well-developed and typical sporocarps. Sporotheca lenticular, umbilicate at the base. Stalk dark brown. Peridium whitish with calcium carbonate granules and a pale brown base. Capillitium with elongated and whitish nodes. Spores 10–12 µm diam., verrucose with warts in groups.

Although a second specimen (BAFC 22876) is well-developed, the capillitium is badhamioid due to the large nodes, the spores are larger (11–14 µm diam.), and the ornamentation on the spores is fainter.

Under SEM, short (<0.5 µm long) bacula were observed, the pilate type as described by Rammeloo (1975).

Specimens examined: **ARGENTINA, Buenos Aires, Laguna Vitel**, on debris of a member of the *Palmaceae*, X–1969, leg. J.R. Deschamps [as *Physarum pusillum,* rev,

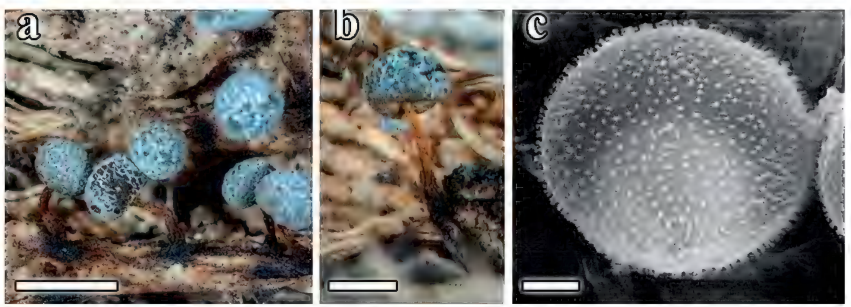

Fig. 14 ***Physarum pusillum*** (BAFC 22876):
a. Sporocarps and capillitium; b. Detail of the umbilicate sporotheca; c. Spore.
Scale bars: a = 1 mm; b = 0.5 mm; c = 2 µm.

Eva García Carvajal *P. pusillum*] (BAFC 22279); on palm decaying, 3–VIII–1968, leg. J.R. Deschamps [as *Physarum pusillum,* rev. Eva García Carvajal *P. pusillum*] (BAFC 22231); **Manzanares**, on spathe of *Palmaceae*, 1–V–1972, leg. G. Cohen [as *Physarum pusillum,* rev. Eva García Carvajal *P. pusillum*] (BAFC 22876).

Remarks—*Physarum pusillum* is a cosmopolitan species (Martin & Alexopoulos 1969). Crespo & Lugo (2003) cited it as widely distributed in Argentina.

Physarum robustum (Lister) Nann.-Bremek.,
Proc. Kon. Ned. Akad. Wetensch., C. 76(5):484 (1973)

LIL 153185 has stalked sporocarps; peridium membranous with granules coming from protrusions of the capillitium nodes, which are joined in the center of the sporotheca, forming a pseudocolumella with a variable morphology; spores 10–12 µm diam., violaceous-brown, verrucose.

LIL 153184 has abundant and whitish calcareous capillitium nodes with a variable morphology, but a pseudocolumella is present in only a few sporocarps.

Specimens examined: **ARGENTINA, Tucumán, Tafí,** el Rincón, provincial route 325, 26°57′40″S 65°46′34″W, 2300 m in ravine with alders (*Alnus acuminata*), 4–IV–2014, leg. C. Izarduy & A. Hladki 5033 (LIL 153184); 5038 (LIL 153185; with *Cribraria purpurea*).

Remarks—The spores in both specimens of *Physarum robustum* are 10–12 µm diam., which match those cited by Nannenga-Bremekamp (1991). Poulain & al. (2011) reported slightly smaller (9–10.5 µm diam.) spores.

Physarum robustum could be confused with *P. leucophaeum* and *P. album*. The main difference in *P. leucophaeum* is its lower number of calcium carbonate nodes, leading us to suspect that *P. robustum* and *P. leucophaeum* represent extreme variants of the same species.

Physarum album can be distinguished by its delicate sporocarps, lower number of capillitial nodes, and the stellate dehiscence.

Moreno & al. (2013b) and Lado & al. (2014) previously reported *P. robustum* for Argentina.

Physarum roseum Berk. & Broome, J. Linn. Soc., Bot. 14: 84. 1873. Fig. 15

BAFC 26540 contains abundant, well-developed sporocarps, with a globose sporotheca showing the typical purple color with pink shades. Capillitium filamentous with small, purple nodes. Spores 7–8 µm diam., violaceous-brown, verrucose with warts in groups.

Specimen examined: **USA, Maryland,** Beltsville, on decaying logs, twigs, leaves, etc., 7–VIII–1969, leg. & det. M.L. Farr 4062 [as *Physarum roseum*] (BAFC 26540).

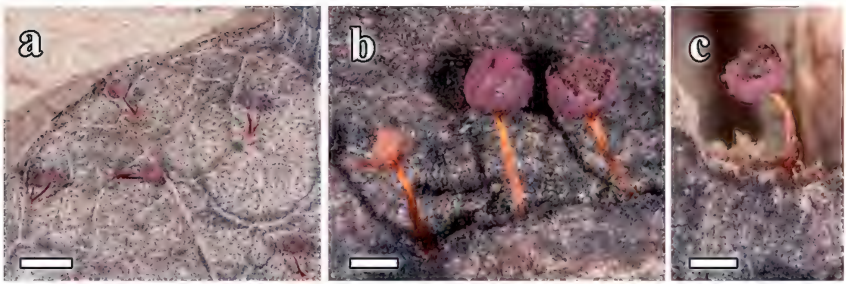

Fig. 15 ***Physarum roseum*** (BAFC 26540):
a. Sporocarps; b, c. Detail of sporocarps and capillitium. Scale bars: a = 1 mm; b, c = 0.5 mm.

Remarks—Martin & Alexopoulos (1969) indicated that *Physarum roseum* is closely related to *P. pulcherrimum* Berk. & Ravenel., which produces violet instead of pinkish sporocarps (see macro- and micrographs of *P. pulcherrimum* in Moreno & al. (2014) for color comparison).

Our material of *P. roseum* resembles that photographed by Poulain & al. (2011). Martin & Alexopoulos (1969) cited *P. roseum* as occurring in North America.

Stemonitis smithii T. Macbr., Bull. Iowa Univ. Lab. Nat. Hist. 2(4): 381. 1893.

LIL 153186 displays the characters typical of the species, including a well-developed external mesh in the periphery of the capillitium, a cylindrical hollow stalk, and spores 4–5 µm diam., pale violaceous-brown, almost smooth to slightly verrucose.

Specimen examined: **ARGENTINA, Tucumán, Chicligasta**, National Park los Alisos, 867 m, on wood of *Ocotea porphyria*, 18–V–2015, leg. P. Medina & A. Hladki 699 (LIL 153186).

Remarks—Moreno & al. (2013a) carried out a SEM study of other Argentinian specimens of *Stemonitis smithii*. *Stemonitis smithii* is rarely cited as occurring in Argentina according to Crespo & Lugo (2003).

Trichia crateriformis G.W. Martin, Mycologia 55(1): 131. 1963. Fig. 16

= *Trichia fallax* var. *olivacea* Meyl., Bull. Soc. Vaud. Sci. Nat. 44: 300. 1908.
≡ *Trichia decipiens* var. *olivacea* (Meyl.) Meyl., Bull. Soc. Vaud. Sci. Nat. 55: 244. 1924.
≡ *Trichia decipiens* f. *olivacea* (Meyl.) Y. Yamam., Myxomyc. Biota Japan.: 237. 1998.

LIL 153187 contains five well-developed sporocarps. Capillitium formed by elaters, 5–6 µm diam., with quite long tips. Spores 10–11 µm diam. with short crests. Under SEM, the spore ornamentation is formed by ≤0.5 µm long bacula joined into sinuous and irregular crests.

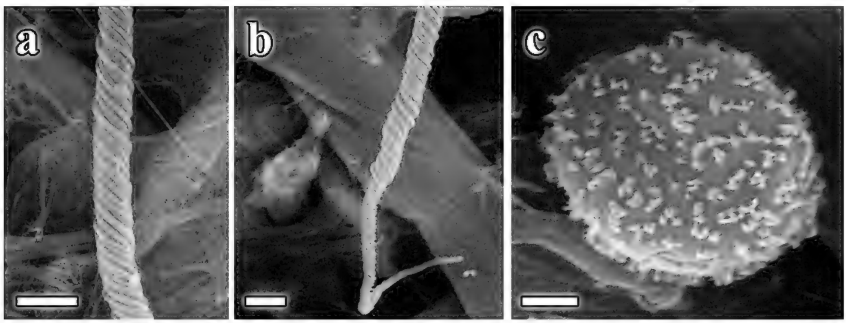

Fig. 16 *Trichia crateriformis* (LIL 153187):
a. Capillitium; b. Tip of one elater; c. Spore. Scale bars: a, b = 5 µm; c = 2 µm.

Specimen examined: **ARGENTINA, Tucumán, Tafí,** el Potrerillo, 2167 m, on wood debris, 5–IV–2014, leg. C. Izarduy & A. Hladki 5041 (LIL 153187).

Remarks—Moreno & Castillo (2013) explained the priority of the epithet *crateriformis* for the species and how *T. crateriformis* differs from *T. decipiens,* with which it is often confused.

Trichia crateriformis was cited once (as *Trichia pusilla*) as occurring in Tierra del Fuego (Argentina) by Arambarri (1975); this record was later revised by Moreno & al. (2013a) as *Trichia decipiens* var. *olivacea.*

Trichia scabra Rostaf., Sluzowce Monogr. 258. 1875. Fig. 17

LIL 153188 consists of four small pieces of wood, bearing 2–4 sporocarps on each piece. Sporocarps sessile, golden-brown. Peridium simple, very thin, iridescent. Capillitium orange-brown to orange-yellowish, formed by 3–4 µm diam. elaters, ending in a very short tip with a small appendage; under LM the protruding elater spirals appeared to bear short spinules, but no spinules were seen under SEM. Spores 12–13 µm diam., with a low walled reticulum forming abundant meshes. SEM study, which confirmed this ornamentation, also revealed small holes in the walls, described as the simple reticulate with perforated muri type by Rammeloo (1974).

Specimen examined: **ARGENTINA, Tucumán, Tafí,** el Rincón, provincial route 325, 2300 m, on bark of *Alnus acuminata*, 4–IV–2014, leg. C. Izarduy & A. Hladki 5039 (LIL 153188).

Remarks—*Trichia scabra* was cited as occurring in Argentina for the first time by Grosso (1981) and later by Lado & al. (2014), who conducted a SEM study of the spore ornamentation, defining it as "reticulum made up of non-pitted narrow muri," and the elaters "decorated with 3–4 spiny bands."

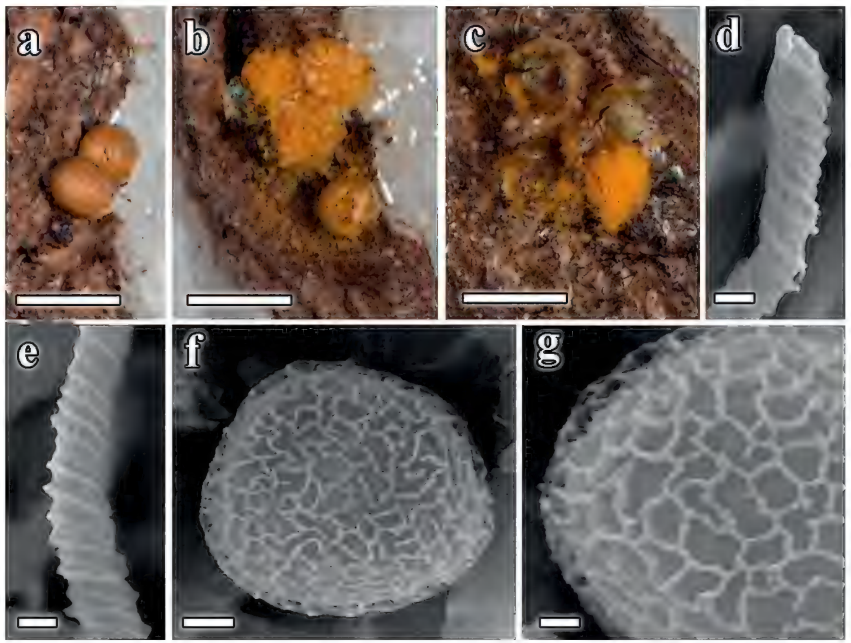

Fig. 17 ***Trichia scabra*** (LIL 153188): a–c. Sporocarps and capillitium; d, e. Capillitium; f. Spore; g. Detail of the spore ornamentation. Scale bars: a–c = 5 mm; d–f = 2 µm; g = 1 µm.

In contrast, our specimen shows the reticulated spores with holes on the walls and smooth elaters. Collections of this species from Taiwan (China) (Liu 1982) displayed the same characters as our specimen.

Acknowledgements

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Varioseptispora chinensis gen. & sp. nov., *V. apicalis* nom. nov., *V. hodgkissii* comb. nov., and *V. versiseptatis* comb. nov.

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Abstract—*Varioseptispora chinensis*, a new genus and species, collected on decaying twigs of unidentified plants in Hainan, China, is described and illustrated. The genus is characterized by macronematous, unbranched, conidiophores with polytretic, integrated, terminal or intercalary conidiogenous cells that produce solitary, acropleurogenous distoseptate and euseptate, brown conidia. The illegitimate *Helminthosporium apicale* V. Rao & de Hoog is accommodated in *Varioseptispora* as the replacement name *V. apicalis*; and two *Spadicoides* spp. are accommodated as the new combinations *V. hodgkissii* and *V. versiseptatis*. A synoptic table and key to *Varioseptispora* species are provided.

Key words—asexual *Ascomycota*, hyphomycetes, saprobes, taxonomy

Introduction

While studying the saprophytic microfungi associated with plant debris in Hainan, China, an undescribed hyphomycete was discovered that is easily referable to *Helminthosporium* Link (Link 1809) and *Spadicoides* S. Hughes (Hughes 1958), except that its conidia are distoseptate and euseptate. Similarly, *Helminthosporium apicale* V. Rao & de Hoog, and *Spadicoides hodgkissii* and *S. versiseptatis* also have distoseptate and euseptate conidia (Rao &

de Hoog 1986, Ho & al. 2002, Wong & al. 2002). These four species are not in accordance with the *Helminthosporium* and *Spadicoides* generic concepts; therefore we propose a new genus and species *Varioseptispora chinensis* and a replacement name and two new combinations for the *Helminthosporium* and *Spadicoides* species.

Materials & methods

Samples of litter were placed in paper and plastic bags, taken to the laboratory, and prepared according to Castañeda-Ruiz & al. (2016). Mounts were prepared in PVL (polyvinyl alcohol and lactic acid) and measurements were made at a magnification of ×1000. Micrographs were obtained with a Nikon Eclipse 80i microscope equipped with bright field and Nomarski interference optics. The type specimen was deposited in the Herbarium of Jiangxi Agricultural University, Nanchang, Jiangxi, China (HJAUP).

Taxonomy

Varioseptispora L. Qiu, Jian Ma, R.F. Castañeda & X.G. Zhang, **gen. nov.**

MB 833082

Differs from *Helminthosporium* and *Spadicoides* by its distoseptate and euseptate conidia.

Type species: *Varioseptispora chinensis* L. Qiu & al.

Etymology: *Vario-* (Latin) meaning variable + *septispora* (Latin) referring to the septate spores.

Conidiophores macronematous, mononematous, unbranched, erect, cylindrical, smooth, septate, brown to dark brown, with or without enteroblastic percurrent regenerations. Conidiogenous cells polytretic, integrated, terminal or intercalary, determinate, cylindrical, with several conspicuous pores. Conidial secession schizolytic. Conidia solitary, acropleurogenous, dry, clavate, obclavate or obovoid, distoseptate and euseptate, brown to pale brown, smooth.

Varioseptispora chinensis L. Qiu, Jian Ma, R.F. Castañeda & X.G. Zhang, **sp. nov.** Fig. 1

MB 833083

Differs from *Helminthosporium* and *Spadicoides* spp. by its clavate conidia (3–)4–5 distoseptate with a basal euseptum.

Type: China, Hainan Province: Jianfengling Mountain, on decaying twigs of an unidentified broadleaf tree, 15 April 2014, J. Ma (**holotype**, HJAUP M0405).

Etymology: refers to the country in which the fungus was collected.

Colonies on natural substrate effuse, hairy dark brown. Mycelium partly superficial, partly immersed in the substrate, composed of branched, pale

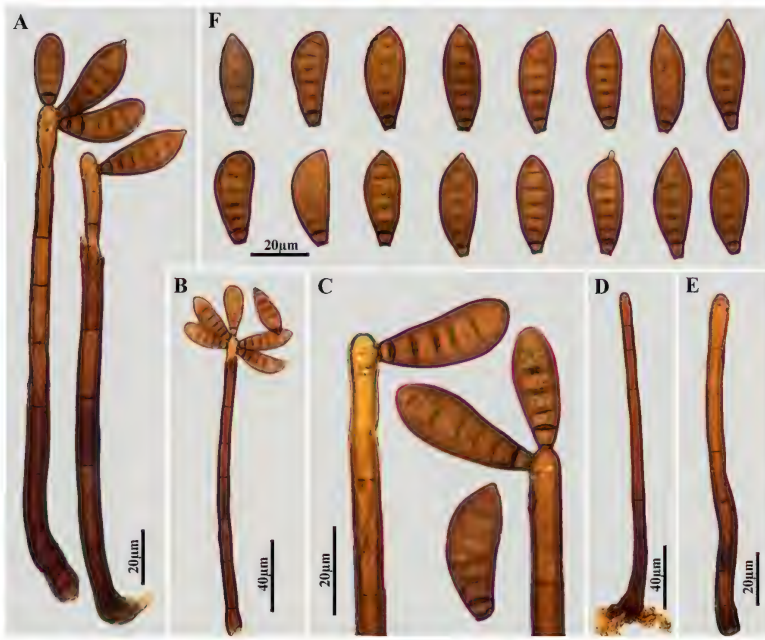

Fig. 1. *Varioseptispora chinensis* (holotype, HJAUP M0405).
A, B. Conidiophores, conidiogenous cells, and conidia;
C. Conidiogenous cells, and conidia; D, E. Conidiophores; F. Conidia.

brown, septate, smooth-walled hyphae. Conidiophores macronematous, mononematous, unbranched, erect, straight or slightly flexuous, cylindrical, smooth, septate, brown to dark brown, 124–216 × 7.5–9.5 μm, with 1 enteroblastic percurrent regeneration. Conidiogenous cells polytretic, integrated, cylindrical, terminal, determinate, smooth, brown, 17–32.5 × 6.5–8 μm. Conidial secession schizolytic. Conidia solitary, acropleurogenous, dry, straight or slightly curved, clavate, apex rounded or with conical apex ending in a rounded papilla, base truncate, smooth-walled, reddish brown, (3–)4–5-distoseptate with 1-euseptate near the base, 30–38 × 11.5–14 μm, 3–4 μm wide at the truncate base.

Varioseptispora apicalis Z.H. Xu, Jian Ma, X.G. Zhang & R.F. Castañeda, **nom. nov.**
MB 833084
≡ *Helminthosporium apicale* V. Rao & de Hoog, Stud. Mycol. 28: 70 (1986), nom. illeg. (non Berk. & Broome 1861).

Table 1 Synoptic comparisons of *Varioseptispora* species

Species	Conidiophores		Conidiogenous cells	Conidia				Substrate
	Regenerations	Size (μm)		Shape	Size (μm	Septa	Colour	
V. apicale	Yes	130–260 × 4–7	Terminal	Obclavate	28–38 × 7–9	1–2-euseptate above; 3-distoseptate below	Pale olivaceous brown; apical cell somewhat lighter	Rotten leaves
V. chinensis	Yes	124–216 × 7.5–9.5	Terminal	Clavate	30–38 × 11.5–14	3–5-distoseptate above; 1-euseptate below	Reddish brown	Decaying twigs
V. hodgkissii	No	60–120 × 3.5–4	Terminal & intercalary	Obovoid	9–13 × 5–8	0–1-euseptate below or both 1-euseptate below & 1-distoseptate above	Distal cells olivaceous brown: basal cells hyaline or very pale brown	Decaying wood baits
V. versiseptatis	No	90–125 × 3–3.5	Terminal & intercalary	Obovoid	13–14 × 5.5–6	2-euseptate below; 1-distoseptate above	Brown, paler at the base	Decaying culms

Varioseptispora hodgkissii (W.H. Ho, Yanna & K.D. Hyde) Z.H. Xu, Jian Ma, X.G. Zhang & R.F. Castañeda, **comb. nov.**

MB 833085

≡ *Spadicoides hodgkissii* W.H. Ho, Yanna & K.D. Hyde, Mycologia 94(2): 302 (2002), [as '*hodgkissa*'].

Varioseptispora versiseptatis (M.K.M. Wong, Goh & K.D. Hyde) Z.H. Xu, Jian Ma, X.G. Zhang & R.F. Castañeda, **comb. nov.**

MB 833086

≡ *Spadicoides versiseptatis* M.K.M. Wong, Goh & K.D. Hyde, Cryptog. Mycol. 23(3): 202 (2002).

Note: The characteristics of these four species are summarized in Table 1.

Key to *Varioseptispora* species

1. Conidia obovoid 2
1. Conidia clavate or obclavate 3
2. Conidia 9–13 × 5–8 µm, 0–1-euseptate or with both 1-euseptate below and 1-distoseptate above ..... *V. hodgkissii*
2. Conidia 13–14 × 5.5–6 µm, 2-euseptate below and 1-distoseptate above ..... *V. versiseptatis*
3. Conidia clavate, 30–38 × 11.5–14 µm, (3–)4–5-distoseptate above and 1-euseptate below ..... *V. chinensis*
3. Conidia obclavate, 28–38 × 7–9 µm, 1–2-euseptate above and 3-distoseptate below ..... *V. apicalis*

Discussion

Varioseptispora is characterized by its polytretic, integrated, terminal or intercalary conidiogenous cells on distinct, unbranched, conidiophores, and solitary, acropleurogenous, distoseptate and euseptate conidia. It has the same conidial ontogeny as *Spadicoides* and *Helminthosporium*, but conidia in *Spadicoides* are unicellular or multicellular, euseptate conidia (Hughes 1958, Ellis 1971, Sinclair & al. 1985, Goh & Hyde 1996, Seifert & al. 2011), conidia in *Helminthosporium* are distoseptate, and the conidiophores are with small pores at the apex and laterally beneath the septa (Link 1809, Shoemaker 1959, Ellis 1961, 1971, Siboe & al. 1999, Seifert & al. 2011). In several studies, conidial septation (eu- and distoseptate) has been used as the fundamental criterion for generic circumscription, thus providing a narrow generic concept, which can help avoid confusion and complexity in a number of hyphomycete genera (Subramanian 1992, Wu & Zhuang 2005, Seifert & al. 2011, Ma & al. 2016).

Varioseptispora has polytretic conidiogenesis and solitary conidia similar to several other genera including *Exosporium* Link, *Dendrographium* Massee, *Polytretophora* Mercado, *Weufia* Bhat & B. Sutton, *Porosubramaniania* Hol.-Jech., *Paliphora* Sivan. & B. Sutton, *Benjpalia* Subram. & Bhat, and *Bharatheeya* D'Souza & Bhat (Link 1809, Massee 1892, Mercado-Sierra 1983, Bhat & Sutton 1985, Holubová-Jechová 1985, Sivanesan & Sutton 1985, Subramanian & Bhat 1987, D'Souza & Bhat 2002). However, *Dendrographium* differs by its conidiophores forming synnematous conidiomata and distoseptate conidia; *Bharatheeya* differs by its setiform conidiophores and distoseptate conidia; *Paliphora* differs by its unicellular or multicellular, euseptate conidia; *Polytretophora* differs by its curved, 1-euseptate conidia with pigmented basal cell and hyaline apical cell. *Porosubramaniania*, *Benjpalia*, *Exosporium* and *Weufia* differ by their conidiogenous cells with cicatrized pores and conidia with only eusepta or distosepta.

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Phaeocandelabrum pseudocallisporum sp. nov. from Brazil

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Abstract—*Phaeocandelabrum pseudocallisporum*, collected on decaying twigs in the Brazilian Cerrado of Mato Grosso do Sul State, is described and illustrated as a new species. The fungus is characterized by complex conidia with two brown central cells and 4–6 secondary cells that produce 4–5 tertiary cells at the apex. This species is easily distinguished from *P. callisporum* by the presence of stellate tertiary cells that produce five radial projections.

Key words—conidial fungi, taxonomy. tropical fungi

Introduction

Phaeocandelabrum R.F. Castañeda & al. is characterized by acrogenous complex multi-cellular branched and irregular pyramidal, turbinate, globose, or Y-shaped conidia produced by rhexolytic secession. The complex conidia are composed of a central cell giving rise to secondary and tertiary cells (Castañeda-Ruiz & al. 2009). *Phaeocandelabrum* comprises three species: *P. elegans* (R.F. Castañeda) R.F. Castañeda & al. (type), *P. callisporum* Gusmão & al., and *P. joseiturriagae* R.F. Castañeda & al. During a survey of microfungi associated with twigs from an urban fragmental Cerrado forest in the Private Natural Heritage Reserve of the Federal University of Mato Grosso do Sul (RPPN/UFMS), we collected an interesting specimen described below as a new *Phaeocandelabrum* species.

Materials & methods

Samples of decaying twigs were collected and placed in paper bags. In the laboratory, the samples were processed following Castañeda-Ruiz & al. (2016) and regularly examined for 40 days under a Leica S8AP0 stereomicroscope for reproductive structures. Slide mounts were prepared in PVL (polyvinyl alcohol, lactic acid, and phenol) and/or in lactic acid. Microphotographs were obtained with the Olympus BX51 microscope with Differential Interference Contrast (DIC) optics. The type specimen is deposited in the Herbarium of Universidade Estadual de Feira de Santana, Brazil (HUEFS).

Taxonomy

Phaeocandelabrum pseudocallisporum Careli & Gusmão, **sp. nov.** PLATE 1

MB 833013

Differs from *Phaeocandelabrum callisporum* by the presence of sickle-shaped tertiary cells.

TYPE: Brazil, Mato Grosso do Sul State: Campo Grande, Private Natural Heritage Reserve of the Federal University of Mato Grosso do Sul (RPPN/UFMS), 20°30′S 54°36′W, on decaying twigs of unidentified plant, 24.VIII.2018, coll. Santos, DC (**Holotype**, HUEFS 252202).

ETYMOLOGY: Greek, *pseudo-*, meaning false, indicating its similarity to *P. callisporum*.

MYCELIUM superficial and immersed, hyphae branched, septate, smooth, and pale brown. CONIDIOPHORES macronematous, mononematous, usually unbranched, cylindrical, erect, straight, or slightly flexuous, smooth, 3–5-septate, pale brown, slightly swollen at the base, 69–88 × 5–6 µm. CONIDIOGENOUS CELLS monoblastic, terminal, integrated, cylindrical, smooth, with 2–4 percurrent extensions, pale brown. Conidial secession rhexolytic. CONIDIA solitary, acrogenous, subglobose to broadly ellipsoid, smooth, dry, brown, with a basal frill, 24–26 × 21–24 µm; complex and comprising i) 2 thick-walled central cells, 8–11 × 7–11 µm, brown to dark brown, apical cell globose and basal cell slightly turbinate; ii) 4–6 cylindrical to doliiform secondary cells, 4–6 × 4–5 µm, pale brown; and iii) 4–5 sickle-shaped tertiary cells, 10–11.5 × 1–1.5 µm, pale brown.

NOTE: Three species have been previously included in *Phaeocandelabrum*. The most similar to *P. pseudocallisporum* is *P. callisporum*, which also presents complex conidia, with two central cells and more or less doliiform secondary and tertiary cells. However, in *P. callisporum* the conidia are pale brown with stellate tertiary cells characterized by 5 radial projections (Castañeda-Ruiz & al. 2009). *Phaeocandelabrum pseudocallisporum* is easily distinguished from the other species of *Phaeocandelabrum* by the brown, thick-walled

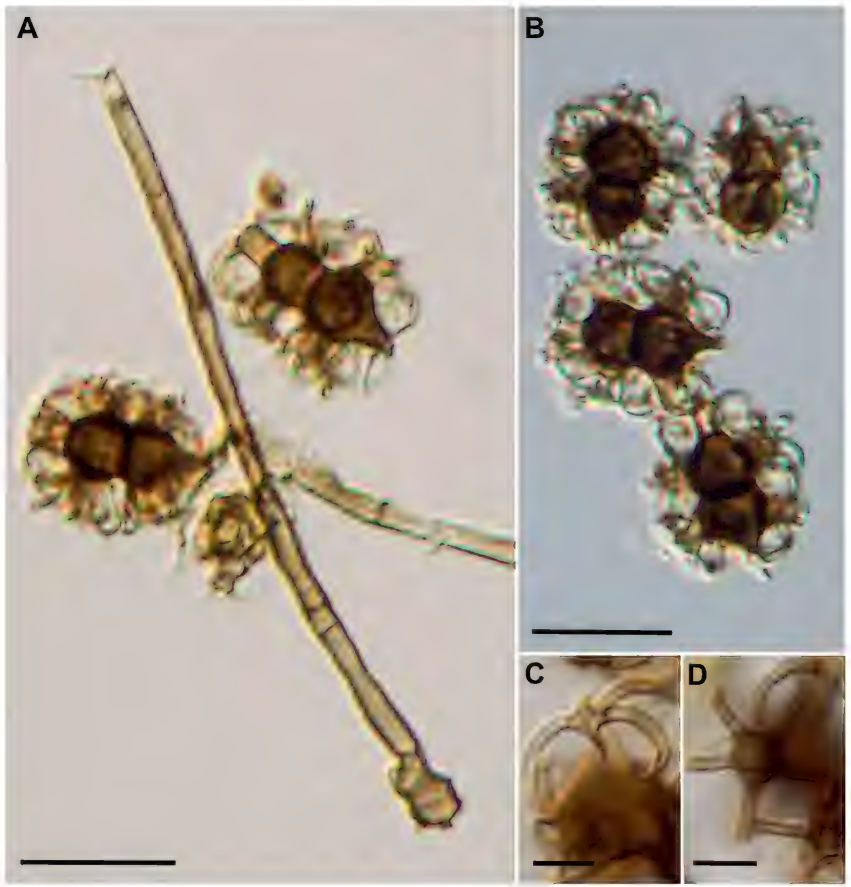

Fig. 1. *Phaeocandelabrum pseudocallisporum* (holotype, HUEFS 252202): A. Conidiophore with conidia (general aspect); B. Conidia; C. Sickle-like tertiary cells (detail); D. Secondary cell with five tertiary cells (top view). Scale bars: A, B = 20 µm; C, D= 5 µm.

conidia, with two central cells, and 4–6 secondary cells which originate 4–5 tertiary cells sickle-shaped at the apex. For a reliable taxonomic decision, the type material of *P. callisporum* (HUEFS56701) was analyzed. There are no molecular data on *Phaeocandelabrum* spp. to date.

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Russula rubricolor sp. nov. from Himalayan forests of Pakistan

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Abstract—A new species, *Russula rubricolor,* was collected in the Himalayan forests of Pakistan. This species is morphologically characterized by the yellowish hymenium, bright red pileus that is convex to flat with central depression and finally infundibuliform and striate towards margin, becoming blackish red with age. The newly reported species is placed in *Russula* subsect. *Maculatinae* based molecular phylogenetic analysis of ITS sequence data and supported by the red pileus color.

Key words—*Cedrus,* phylogeny, *Quercus, Russulaceae*, taxonomy

Introduction

The monophyletic genus *Russula* Pers. (*Russulaceae*) is the largest genus in *Russulales* (Singer 1986, Buyck & Horak 1999, Buyck & al. 2008, Li & al. 2015, Ghosh & al. 2016). Resupinate, discoid, effused-reflexed, clavarioid, pileate, or gasteroid basidiomata can be found in this order (Miller & al. 2006, Kirk & al. 2008, Wang & al. 2009, Li & al. 2018). *Russula* is one of the most species-rich agaric genera in *Russulales,* making species recognition often difficult. The genus is generally easily distinguished from its sister genera *Lactarius* Pers. and *Lactifluus* (Pers.) Roussel in the field by absence of latex and under the microscope by presence of complex agglomerated sphaerocytes and absence

of pseudocystidia or lactiferous hyphae (Verbeken 1996). *Russula* subsect. *Maculatinae* (Konrad &Joss.) Romagn. is characterized by the yellow spore print, acrid taste of the flesh, and non-incrusted pileocystidia with contents that turn grey in sulphovanillin (Adamčík & Jančovičová 2012).

Russula is globally distributed and occurs across a wide range of habitats from the tropics to polar ecosystems (Miller & Buyck 2002, Park & al. 2013, Lee & al. 2017). The genus plays an important role in forest ecosystems as its members are ectomycorrhizal symbionts with a wide range of trees including angiosperms and gymnosperms (Richardson 1970; Bills & al. 1986; Villeneuve & al. 1989; Claridge & May 1994; Buyck & al. 1996; Gardes & Bruns 1996; Ahmad & al. 1997; Niazi & al. 2006; Niazi 2008; Razaq & al. 2014; Jabeen & al. 2015, 2016, 2017a,b; Saba & Khalid 2015.

Fungal forays to the Abbottabad and Swat districts were conducted during 2014–16 to inventory the macrofungi of the area. One *Russula* species stood out as different and is introduced here as a new species, based on a detailed morphological description and comparison of its ITS sequences with those available in GenBank.

Materials & methods

Specimens were photographed in field, air dried, described and deposited in the Herbarium, Department of Botany, University of the Punjab, Lahore, Pakistan (LAH). Color codes were given following Munsell soil color charts (Munsell 1975). Potassium hydroxide (KOH 5% aq. w/v) was used to rehydrate dried tissues. Congo red (1% aq. w/v) was used as mounting medium to visualize hyphal walls and contents in microscopic studies. Melzer's reagent and sulphovanillin were used for chemical tests. For scanning electron microscopy, tissue from the hymenium was mounted on a metal stub using double sided adhesive tape and covered with a fine layer of gold in a JEOL ion sputter JFC-1100 and then examined using a JEOL JSM-6360 Scanning Electron Microscope at 20 kV. The notation "basidiospores (*n/m/p*)" indicate that measurements were made from *n* basidiospores of *m* basidiomata and *p* collections. The ornamentation is excluded. Q = l × w ratio; definitions of spore Q values follow Bas (1969).

Genomic DNA was obtained from dried basidiomata using the CTAB procedure (Gardes & Bruns 1993). The primer pair ITS1F (Gardes & Bruns 1993) and ITS4 (White & al. 1990) was used to amplify the ITS region. PCR was performed in a total volume of 25 µl containing 2.5 µl of PCR reaction buffer, 0.6 µl of dNTP mix (2.5 mM), 1 µl of each primer (10 µM), 0.2 µl of *Taq* polymerase, and 0.5 µl of DNA template beginning with a 4 min initial denaturation at 94°C, followed by 34 cycles of denaturation at 94°C for 40s, annealing at 52°C for 60s, at 72°C for 80s, and by a final extension at 72°C for 8 min. The PCR amplicons were purified using Exonuclease I and Shrimp Alkaline Phosphatase enzymes (Werle & al. 1994).

Purified PCR products were sequenced by the Beijing Genomic Institute P.R. in China using the same ITS1F & ITS4 primers. DNA sequences were trimmed, edited, and assembled using Sequencher® 5.41 software. Closely related BLAST-search sequences and published sequences (Adamčík & al. 2016, 2019; Li & al. 2018) were downloaded from GenBank and UNITE to reconstruct the phylogeny. The sequences selected were derived from types (preferred), representatives of same species, and others with complete ITS regions. Environmental sequences closely related to the Pakistani specimens were also included in the final ITS dataset to determine distribution. Ambiguously aligned sequences were excluded after preliminary analysis. Sequences were aligned using MUSCLE v3.6 (Edgar 2004). DNA sequences generated for this study were deposited in GenBank under accession numbers MK142795–MK142798.

A maximum likelihood tree was inferred using Kimura 2-parameter model (K2+G) (Kimura 1980) by best DNA model selection in MEGA 6 (Tamura & al. 2013). A discrete Gamma distribution was used to model evolutionary rate differences among sites [5 categories (+G, parameter = 0.4241)]. The percentage of trees in which the associated taxa clustered together is shown next to the branches. The tree is drawn to scale, with branch lengths measured in the number of substitutions per site. The analysis involved a selection of 121 nucleotide sequences. *Russula sardonia* Fr. (KT933999) and *R. emetica* (Schaeff.) Pers. (JQ888196) were selected as outgroup taxa from *Russula* core clade while others represent *Russula* crown clade (Adamčík & al. 2019). There were a total of 725 positions in the final dataset. One thousand bootstrap iterations were performed with rapid bootstrapping in MEGA 6 for phylogenetic tree construction (Tamura & al. 2013).

Phylogenetic results

BLAST search of the consensus sequence from LAH35070 at NCBI database revealed a 97% identity among LAH35070 and unidentified *Russula* sequences KM576560 from UK and KU914610–KU924613 from China with 100% query cover. It also showed 97% identity with a *Russula* sp. (AF418639) sequence from ectomycorrhizal root tips from Germany, indicating that the sequence from collection LAH35070 (haplotype) separated from all currently available sequences in public databases.

In the phylogram generated by ML analysis of the ITS sequences (Fig. 1), the *Russula rubricolor* sequences clustered in a clade with MG719932 and MG719933 from *R. heilongjiangensis* G.J. Li & R.L. Zhao from China and an unidentified *Russula* sp. (KM57656 from China; KU914610–KU924613 from Germany; and AF418639 from United Kingdom). A species complex comprising *R. globispora* (J. Blum) Bon and *R. dryadicola* R. Fellner & Landa is sister to the *R. rubricolor*/*R. heilongjiangensis* clade. Sequences from the Pakistani collections formed a separate clade with strong bootstrap support of

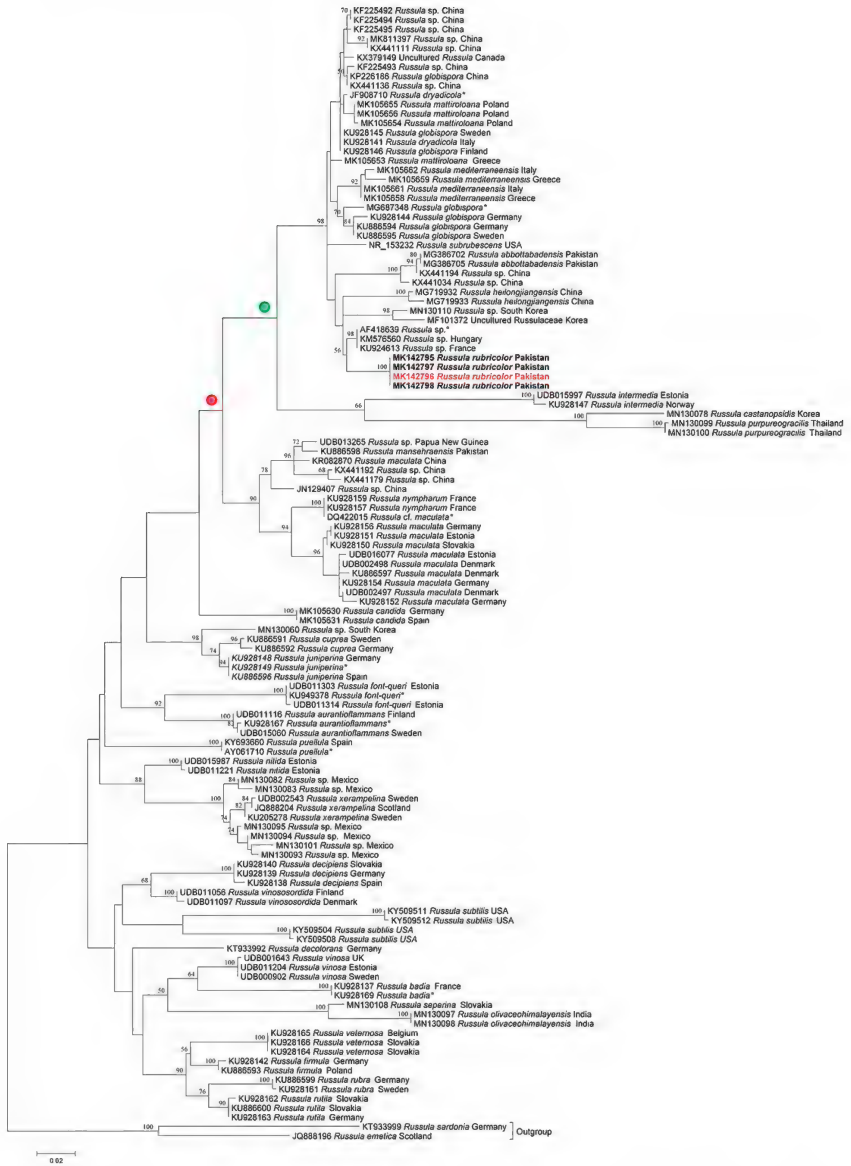

Fig. 1. Molecular analysis of *Russula rubricolor* based on ITS sequences. The evolutionary history was inferred by the Maximum likelihood. The sequences generated during this study are shown with bold text. Red represents the sequence from type collection. Scale bar indicates the number of nucleotide substitutions per site. Asterisk (*) represents unspecified sampling area. Green dot represents *R. globispora* complex and red dot represents *R.* subsect. *Maculatinae*.

its independent position in *R.* subsect. *Maculatinae*. The clades recovered in the phylogenetic analysis correspond to those in Adamčík & al. (2016, 2019) and Li & al. (2018).

Taxonomy

Russula rubricolor Jabeen, Naseer & Khalid, **sp. nov.** FIGS 2–4

MB 828578

Differs from *Russula heilongjiangensis* by its larger pileus and larger basidiospores with isolated to fused warts.

TYPE: Pakistan, Khyber Pakhtunkhwa province, Hazara division Abbottabad district, Shimla Hill, 1500 m a.s.l., on soil under *Cedrus deodara* (Roxb. ex D. Don) G. Don, 21 Aug, 2014, Sana Jabeen & Abdul Nasir Khalid SJ105 (**Holotype** LAH35071; GenBank MK142796).

ETYMOLOGY: The specific epithet *rubricolor* refers to red color of the pileus.

PILEUS 5–8.2 cm broad, convex to plane, infundibuliform in age, centre depressed; surface dry, smooth; margin striate, incurved; yellowish red (7YR 3.6/6) when young, becoming bright red (3.7YR 1.6/4.8) to blackish red (2.5YR 0.9/1.8) when mature. LAMELLAE 0.2–0.3 cm broad, adnexed, light yellow (6.5Y 5.8/3.2), subdistant to close, regular, entire; lamellulae absent. STIPE 4.2–6 cm long, 1.5–2 cm diam., central, cylindrical, slightly broader towards the base, white (8.8GY 8.9/0.7), smooth to finely wrinkled, fibrillose. ODOR acrid. TASTE not observed. SPORE PRINT not obtained.

BASIDIOSPORES [100/5/3] (9.7–)10.5–10.7(–11.5) × (6.7–)7.6–8.6(–9) µm, Q = (1.1–)1.2–1.3(–1.6), avQ = 1.2, subglobose to broadly ellipsoid (rarely ellipsoid), hyaline to pale yellow in 5% KOH; ornamentation amyloid, composed of prominent warts (0.3–0.6 µm high) that are isolated to fused in long chains; apiculus prominent. BASIDIA (38.3–)41.4–43.1(–44.6) × (10.1–)12.6–14.7(–16.5) µm, clavate to subclavate, tetrasterigmate, contents present. CHEILOCYSTIDIA (44–)54.6–90.2(–131.3) × (10.2–)13.4–18.3(–22.5) µm, fusiform, bear dense crystalline contents, hyaline in KOH, pink in Congo red, grey in sulphovanillin. PLEUROCYSTIDIA (89.4–)91.4–106.7(–110.2) × (9.8–)11.6–13.2(–14.7) µm, narrowly fusiform, hyaline in KOH, pink in Congo red, grey in sulphovanillin. PILEIPELLIS 80.8 µm thick trichoderm; hyphae (2–)2.1–2.3(–2.6) µm wide, branched, septate. PILEOCYSTIDIA (2.3–)2.4–2.7(–2.8) µm wide, single-celled, clavate to cylindrical, with rounded apex, non-incrusted, hyaline in 5% KOH, grey in sulphovanillin; dense at the center becoming sparse towards the margin. STIPITIPELLIS a cutis; hyphae (1.3–)1.6–2.4(–3.2) µm wide, filamentous, branched, septate, hyaline in 5% KOH.

Fig. 2. *Russula rubricolor.* A. LAH35071 (holotype); B. LAH35248. Scale bars = 1 cm.

Fig. 3. *Russula rubricolor* (holotype, LAH35071). A. Basidiospores from different angles; B. Basidia; C. Cheilocystidia; D. Pleurocystidia; E. Pileocystidia in pileipellis; F. Stipitipellis. (A in Melzer's reagent; B–D in Congo red; E, F in KOH). Scale bars = 10 μm.

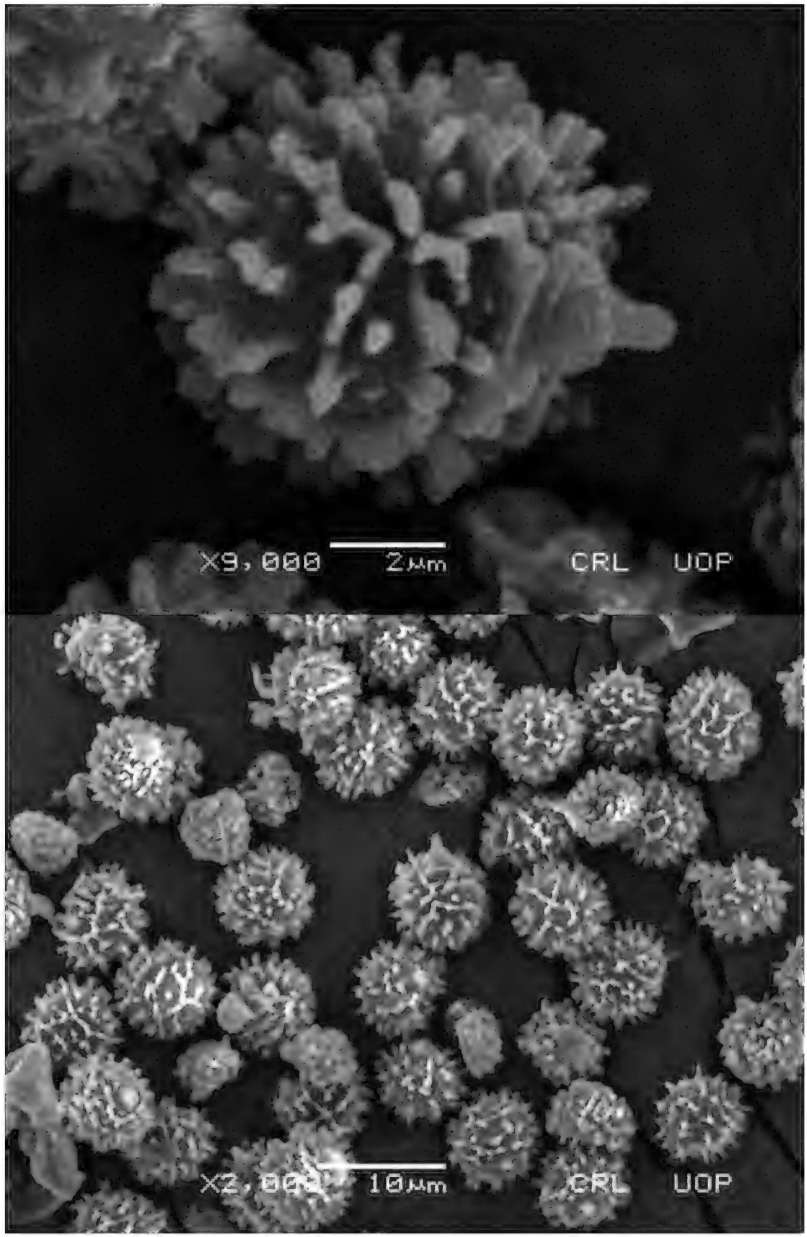

Fig. 4. *Russula rubricolor* (LAH35248). Basidiospores (SEM).

Additional specimens examined: **PAKISTAN. Khyber Pakhtunkhwa, Malakand division**, Swat district, Mashkun, 2500 m a.s.l., on soil under *Cedrus deodara*, 6 August 2014, Sana Jabeen & Abdul Nasir Khalid SJ106 (LAH35070; GenBank MK142795); Toa, 2800 m a.s.l, on soil under *Quercus* sp., 15 July 2015, Arooj Naseer & Abdul Nasir Khalid, ASTB47 (LAH35248; GenBank MK142797, MK142798).

Habitat & distribution—Himalayan moist *Pinaceae*-dominated forests (including *Pinus roxburghii*, *P. wallichiana,* and few *Cedrus deodara*) and dry oak-dominated temperate forests (including *Quercus oblongata*). Currently known only from Pakistan's Khyber Pakhtunkhwa province.

Discussion

Species in *Russula* subsect. *Maculatinae* are characterized by the combination of a red pileus and pileocystidia turning greyish in sulphovanillin (Romagnesi 1967, 1985). The newly described *R. rubricolor* is distinguished primarily by its yellowish hymenium, convex to infundibuliform, yellowish red to bright red or blackish red pileus that is striate towards the edge and which becomes blackish red with age. It is also characterized by large broadly ellipsoid basidiospores covered with isolated to fused warts. Both morphological and phylogenetic analyses confirm the independence and position of *R. rubricolor* in *R.* subsect. *Maculatinae* (Fig. 1), as defined by Adamčík & al. (2016, 2019).

Russula rubricolor clusters in a clade with some unidentified *Russula* species and three closely related species that comprise the *R. globispora* complex. *Russula dryadicola* (described from central European alpine habitats) differs from *R. rubricolor* by its yellow and purple pileus lacking bright red tinges and its medium-sized (4–6 cm) pileus (Sarnari 1998), while the European *R. globispora* is distinguished by its variously colored pilei and longer (41–53 µm) basidia (Sarnari 1998, Adamčík & Jančovičová 2013). *Russula heilongjiangensis* from northeastern China differs from *R. rubricolor* in its smaller (2.8–5.2 cm) pileus (Li & al. 2018).

Another Pakistani species, *Russula abbottabadensis* Saba & Adamčík, was described from the same habitat as *R. rubricolor*. Macroscopically similar to *R. rubricolor, R. abbottabadensis* can be separated by its smooth (not striate) pileal margins, larger (9.9–10.6 ×7.6–8.3 + 3–6 µm ornamentation) basidiospores, and 1–2-celled pileocystidia (Caboň & al. 2019). *Russula abbottabadensis* also clustered in the *Russula* crown clade, but very distant from *R. rubricolor*.-

Russula sharmae K. Das & al., an Indian taxon described based solely on morphological features, can be separated from *R. rubricolor* by its viscid

to glutinous pileus with a strongly sulcate margin, lamellae that fork near the pileus edge, smaller (6.8–7.9 × 6.0–7.0 µm + 1 µm ornamentation) basidiospores, and fusiform to subclavate pleurocystidia with rounded apices (Das & al. 2013).

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Mirohelminthosporium gen. nov. for an atypical *Helminthosporium* species and *H. matsushimae* nom. nov.

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Abstract—*Mirohelminthosporium* is proposed as a new genus for *Helminthosporium bigenum*, characterized by polytretic and blastic conidial ontogeny on the apical conidiogenous cells. A replacement name, *Helminthosporium matsushimae*, is proposed for the illegitimate later homonym *H. cylindrosporum* Matsush.

Key words—asexual *Ascomycota*, *Helminthosporium dimorphosporum*, hyphomycetes, systematics

Introduction

Helminthosporium Link typified by *H. velutinum* Link is characterized by macronematous unbranched erect conidiophores (Link 1809). The conidiogenous cells are polytretic, integrated, terminal and intercalary, and determinate, with the conidiogenous loci at the apex and laterally below the septa. The conidia are solitary, obclavate to cylindrical-obclavate, distoseptate,

sometimes rostrate, smooth, subhyaline, olivaceous, brown, and usually with an evident dark brown or brown basal scar. The *Helminthosporium* generic concept treated by Alcorn (1983, 1988), Ellis (1961, 1971), Hughes (1958, 1980a,b), Shirouzu & Harada (2004), Voglmayr & Jaklitsch (2017), and Zhang & Zhang (2009) clarified the morphological and molecular phylogenetic delimitation of the genus. Additionally, several *Helminthosporium* species with blastocatenate distoseptate and dictyoseptate conidia were transferred into *Ellismarsporium* R.F. Castañeda & X.G. Zhang and *Stanhughesiella* R.F. Castañeda & D.W. Li (Castañeda-Ruiz & al. 2017).

Helminthosporium bigenum has an unusual combination of holoblastic euseptate conidia from apical conidiogenous cells and tretic (enteroblastic) distoseptate conidia from intercalary conidiogenous cells (Matsushima 1993). Conidial ontogeny and conidiogenous events have been considered the fundamental criteria for asexual fungal taxonomy and generic delimitation (Kendrick 2017, Seifert & al. 2011). Consequently, we propose the new genus *Mirohelminthosporium* to accommodate the atypical *Helminthosporium* species, *H. bigenum*. A replacement name, *Helminthosporium matsushimae*, is proposed for the illegitimate later homonym *H. cylindrosporum* Matsush.

Taxonomy

Mirohelminthosporium K. Zhang, D.W. Li & R.F. Castañeda, **gen. nov.**

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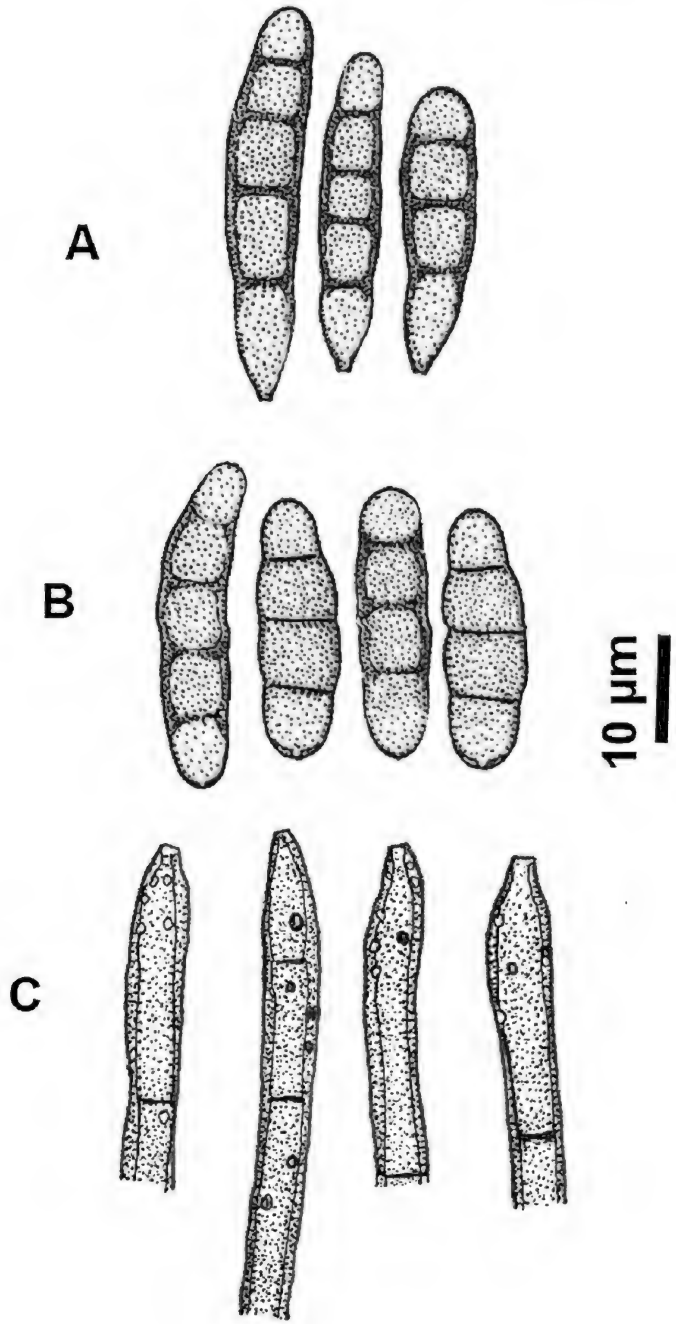
Differs from *Helminthosporium* by its holoblastic and primarily monoblastic conidial ontogeny, and its production of euseptate conidia on the apical conidiogenous cells beside or near the tretic loci.

Type species: *Helminthosporium bigenum* Matsush. [≡ *Mirohelminthosporium bigenum* (Matsush.) K. Zhang & al.]

Etymology: Latin, *Mirus-* meaning wonderful, extraordinary, remarkable + Latin, *-helminthosporium*, referring to the genus *Helminthosporium*.

Colonies on CMA medium hairy, brown to dark brown. Conidiophores macronematous, mononematous, unbranched, erect, straight, cylindrical, septate, smooth, brown to dark brown. Conidiogenous cells biontogenous, sometimes on the same cell: i) polytretic, integrated, mostly intercalary, cylindrical, sometimes terminal with subapical tretic loci and apical blastic loci; ii) monoblastic, integrated, terminal, sometimes with

Fig. 1. *Mirohelminthosporium bigenum* (Adapted from Matsushima 1993, figs 693–696; *H. bigenum* holotype, MFC OP-440). A. Conidia from blastic loci. B. Conidia from tretic loci. C. Conidiogenous cells.


A
B
10 µm
C

several tretic loci near below the blastic locus on the same cell. Conidia solitary, dimorphic: i) acropleurogenous, mostly pleurogenous, cylindrical, oblong, straight or curved, rounded at the ends, melanized or obscure at the base, distoseptate, smooth, brown to dark brown or black, dry, borne on tretic conidiogenous loci; ii) acrogenous, solitary, cylindrical, clavate to subclavate, attenuate, rounded or obtuse at the apex, truncate at the base, euseptate, smooth, brown to dark brown or black, dry, borne on the apical blastic conidiogenous loci.

Mirohelminthosporium bigenum (Matsush.) K. Zhang, D.W. Li & R.F. Castañeda, **comb. nov.** Fig. 1

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≡ *Helminthosporium bigenum* Matsush., Matsush. Mycol. Mem.7: 53 (1993).

Helminthosporium matsushimae D.W. Li, K. Zhang & R.F. Castañeda, **nom. nov.** Fig. 2

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≡ *Helminthosporium cylindrosporum* Matsush., Matsush. Mycol. Mem.7: 54 (1993), nom. illeg. (non Sacc. 1876).

Notes: Index Fungorum (2019) lists 770 taxonomic names in *Helminthosporium*, but many of these have been transferred to the genera *Bipolaris* Shoemaker, *Curvularia* Boedijn, *Drechslera* S. Ito, *Exserohilum* K.J. Leonard & Suggs, *Exosporium* Link, *Ellismarsporium*, and several other genera.

Anisospadicoides R.F. Castañeda & al. is another genus with blastic and tretic conidial ontogeny but in that instance, both types of conidiogenesis produce euseptate conidia (Qiao & al. 2019).

Helminthosporium dimorphosporum Hol.-Jech. (Fig. 3), which produces distoseptate and euseptate conidia through the same tretic loci (Holubová-Jechová 1987), does not fit the *Helminthosporium* generic concept and needs to be revised.

Acknowledgments

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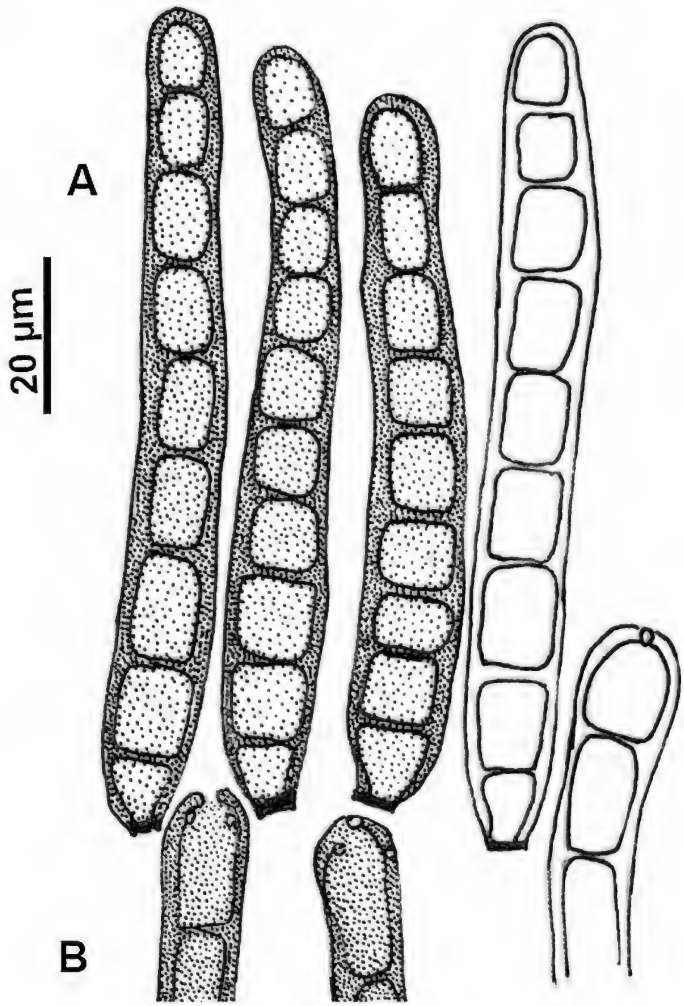

Fig. 2. *Helminthosporium matsushimae*
(Adapted from Matsushima 1993, figs 239, 686; *H. cylindrosporum* holotype, MFC OP-658).
A. Conidia. B. Conidiogenous cells.

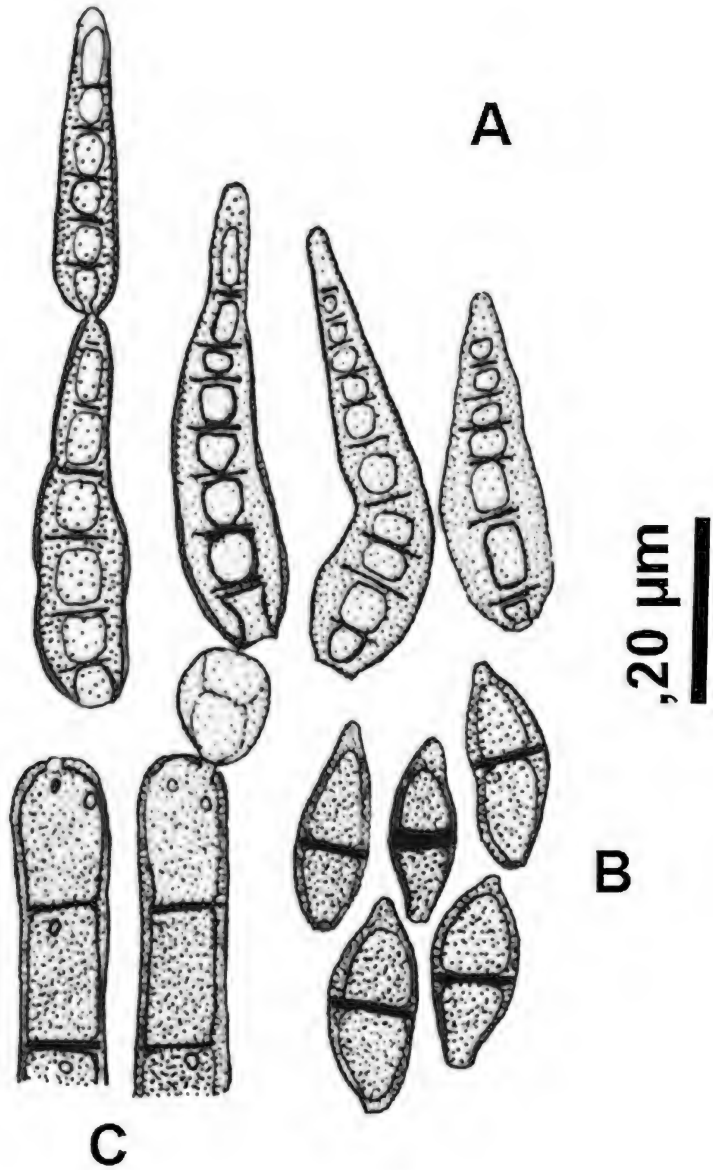

Fig. 3. *Helminthosporium dimorphosporum*
(Adapted from Holubová-Jechová 1987, fig. 2:3, *H. dimorphosporum* holotype, PRM 842 738).
A. Distoseptate conidia. B. Euseptate conidia. C. Conidiogenous cells.

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Lylea obclavata sp. nov. from Lushan Mountain, China

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Abstract—A new species, *Lylea obclavata*, is described and illustrated from a specimen collected on the dead branches of an unidentified plant in Lushan Mountain, China. The fungus is distinguished by its obclavate smooth (1–)2-distoseptate conidia produced in unbranched acropetal chains. A key and synoptic table to *Lylea* species are provided.

Key words—asexual fungi, hyphomycetes, conidial fungi, taxonomy

Introduction

Lylea Morgan-Jones, established by Morgan-Jones (1975) with *L. catenulata* as the type species, was characterized primarily by acrogenous catenate distoseptate conidia that secede schizolytically from monoblastic integrated terminal determinate conidiogenous cells. Morgan-Jones (1975) compared *Lylea* with several other genera including *Septonema* Corda, *Bispora* Corda, *Heteroconium* Petr., *Taeniolella* S. Hughes, *Ampullifera* Deighton, and *Xylohypha* (Fr.) E.W. Mason (Petrak 1949, Corda 1837, Hughes 1958, Deighton 1960) and separated *Lylea* based on its distoseptate conidia. Seifert & al. (2011) pointed out that *Lylea* is similar to *Rhexoprolifer* Matsush., *Pirozynskiella* S. Hughes, and *Repetoblastiella* R.F. Castañeda & al.

However, *Rhexoprolifer* has terminal and intercalary conidiogenous cells with euseptate conidia (Matsushima 1996), *Repetoblastiella* has euseptate conidia forming several irregular chains from several indeterminate cells across the length of the conidial body (Castañeda-Ruíz & al. 2010), and *Pirozynskiella* has euseptate conidia with the centrifugal (then interseptal) septal sequence following the first median septum (Hughes 2007).

Six species have been described within *Lylea: L. catenulata* Morgan-Jones, *L. ficus* J.W. Xia & X.G. Zhang, *L. indica* K.G. Karand. & S.K. Singh, *L. palmicola* Mercado & al., *L. rhopalostylidis* McKenzie, and *L. tetracoila* (Corda) Hol.-Jech. (Table 1). These species are distinguished primarily by conidial shape, size, septation, ornamentation, and unbranched or branched acropetal chains. A synoptic table of the morphological characters of *Lylea* species may also aid in species identification (Xia & al. 2014). Keys to species of *Lylea* have been provided by Holubová-Jechová (1978) and Mercado-Sierra & al. (1997).

During studies on saprophytic microfungi associated with plant debris in the forest ecosystems of southern China, an interesting species with catenate distoseptate conidia and monoblastic conidiogenous cells was collected on dead branches of an unidentified broadleaf tree. The specimen, which manifests the morphological characteristics typical of *Lylea*, differs from other described *Lylea* species in conidial morphology and size and is proposed as new to science.

Materials & methods

Samples of litter were placed in paper and plastic bags, taken to the laboratory, and prepared according to Castañeda-Ruíz & al. (2016). Mounts were prepared in PVL (polyvinyl alcohol and lactic acid) and measurements were made at a magnification of ×1000. Micrographs were obtained with a Nikon Eclipse 80i microscope equipped with bright field and Nomarski interference optics. The type specimen was deposited in the Herbarium of Jiangxi Agricultural University, Nanchang, Jiangxi, China (HJAUP).

Taxonomy

Lylea obclavata L. Qiu, Jian Ma, X.G. Zhang & R.F. Castañeda, **sp. nov.** Fig. 1

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Differs from *Lylea ficus* by its longer and narrower obclavate conidia with (1–)2 distosepta.

Type: China, Jiangxi Province, Lushan Mountain, on dead branches of an unidentified broadleaf tree, 8 November 2014, J. Ma (**Holotype**, HJAUP M0451).

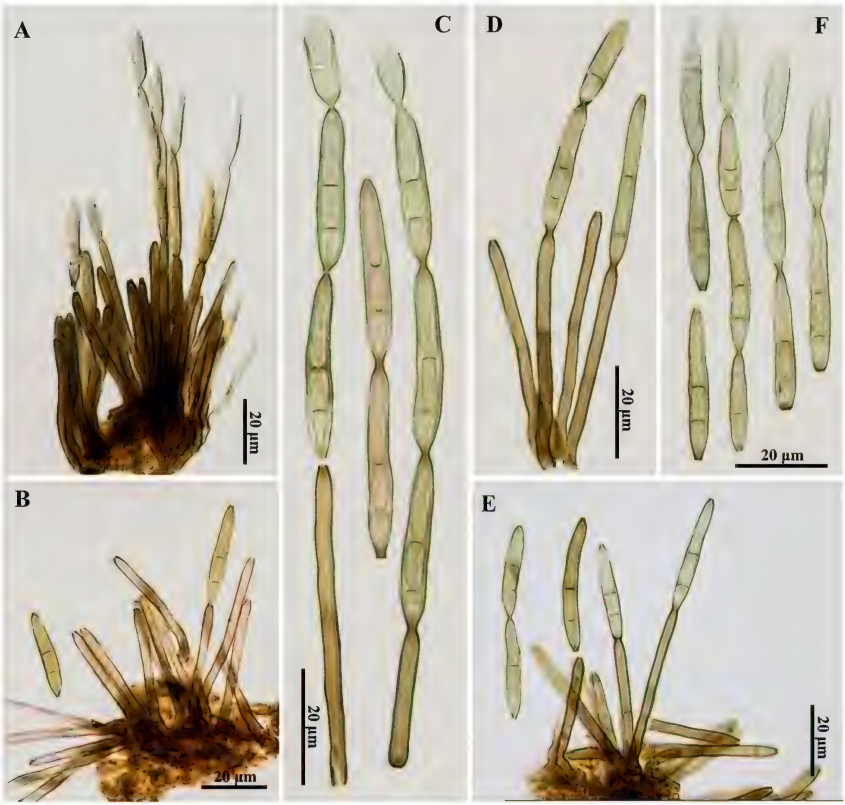

Fig. 1. *Lylea obclavata* (holotype, HJAUP M0451).
A–E. Conidiophores, conidiogenous cells, and conidia; F. Conidia.

Etymology: refers to the obclavate conidial shape.

Colonies on dead wood effuse, brown, hairy. Mycelium partly superficial, partly immersed in the substratum; hyphae branched, septate, pale brown, smooth-walled. Conidiophores macronematous, mononematous, unbranched, erect, cylindrical, 1–2-septate, smooth, pale brown to brown, 34–55 × 2.5–4 μm. Conidiogenous cells monoblastic, integrated, terminal, determinate, cylindrical, smooth, pale brown, 20–26 × 2.5–3.5 μm. Conidial secession schizolytic. Conidia acrogenous, in unbranched acropetal chains, dry, straight to slightly curved, obclavate, with truncate ends, 2(rarely 1)-distoseptate, pale brown, smooth-walled, 19–39 × 3.5–5 μm; 0.8–1.3 μm diam. at the truncate base, slightly melanized.

Table 1. Synoptic table for comparison of *Lylea* species. The new species is set in bold font.

Species	Conidiophores (µm)	Shape	Size (µm)	Septa	Color	branched chains
L. catenulata [1]	---	Cylindrical, obtuse at each end	40–67 × 7–9	(1)4–7(11)	Mid-brown to dark brown	Yes
L. ficus [2]	44–60 × 2.5–3	Fusiform to cylindrical	14–24.5 × 5.5–7	2(–3)	Pale brown	No
L. indica [3]	24–65 × 1.5–2	Cylindrical to fusiform	10–35.5 × 5.5–11.5	3–7	Mid-brown to brown	No
L. obclavata	**34–55 × 2.5–4**	**Obclavate**	**19–39 × 3.5–5**	**(1–)2**	**Pale brown**	**No**
L. palmicola [4]	4–8 × 3–3.5	Cylindrical, ellipsoidal, or fusiform with truncate ends	6–18 × 2.5–4	0–4(3)	Mid-brown to golden brown	No
L. rhopalostylidis [5]	≤90 × 4.5–6	Cylindrical or obclavate, base truncate, apex broadly rounded	30–45 × 5.5–9	(2–)4–6(–10)	Brown	No
L. tetracoila [6]	25–65 × 2.5–3.5	Elongate fusiform or cylindrical	20–40 × 4–5.5	2–4 (mostly 3)	Pale olivaceous brown	Yes

Data from [1] Morgan-Jones 1975; [2] Xia & al. 2014; [3] Karandikar & Singh 2010; [4] Mercado-Sierra & al. 1997; [5] Mckenzie 2009; [6] Holubová-Jechová 1978.

Discussion

Within *Lylea, L. obclavata* is most similar to *L. ficus* in having predominately 2-distoseptate conidia, but *L. ficus* has fusiform to cylindrical, shorter, and wider conidia (Xia & al. 2014). *Lylea obclavata* also differs from the other five species (*L. catenulata*, *L. indica*, *L. palmicola*, *L. rhopalostylidis*, and *L. tetracoila*) by producing obclavate conidia with fewer distosepta. Other differences from *L. obclavata* are larger conidia in branched acropetal chains in *L. catenulata*; wider, darker coloured conidia in *L. indica* and *L. rhopalostylidis*, smaller conidia with smooth to verruculose walls in *L. palmicola,* and predominately 3-distoseptate conidia in occasionally branched acropetal chains in *L. tetracoila* (Table 1). Only *L. tetracoila* was reported to have close associations with some pyrenomycetous fungi.

Key to *Lylea* species

1. Conidia with branched acropetal chains 2
1. Conidia without branched acropetal chains 3
2. Conidia 40–67 × 7–9 µm, 4–7-distoseptate ..... *L. catenulata*
2. Conidia 20–40 × 4–5.5 µm, predominately 3-distoseptate ..... *L. tetracoila*
3. Conidia smooth to verruculose ..... *L. palmicola*
3. Conidia smooth 4
4. Conidia predominantly 2-distoseptate 5
4. Conidia predominantly ≥3-distoseptate 6
5. Conidia fusiform to cylindrical, 14–24.5 × 5.5–7 µm ..... *L. ficus*
5. Conidia obclavate, 19–39 × 3.5–5 µm ..... *L. obclavata*
6. Conidia cylindrical to fusiform,
   10–35.5 ×5.5–11.5 µm, 3–7-distoseptate ..... *L. indica*
6. Conidia cylindrical or obclavate,
   30–45 × 5.5–9 µm, 4–6-distoseptate ..... *L. rhopalostylidis*

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Nomenclature changes in the "Entolomatoid fungi of western North America and Alaska" (Largent 1994)

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Abstract— Nomenclatural omissions and orthographic errors in my 1994 monograph are corrected. The three genera *Calliderma*, *Clitopiloides*, and *Fibropilus* were validly published in 1994 as stat. nov. based on infrageneric names, and their extraterritorial basionym type species are proposed here as *Ca. callidermum* comb. nov., *Cl. cyathus* comb. nov., and *F. fumosifolius* comb. nov. Names originally proposed as provisional are validated as *Leptonia cyanea* comb. nov., *L. cyanea* var. *occidentalis* var. nov., and *Inocephalus appressus* sp. nov. *Nolanea* names that were illegitimate later homonyms are proposed as *N. undatomarginata* comb. nov. and *N. papillatoides* comb. nov., based on published replacement names. The published validation of the invalid 1994 name "*Leptonia violacea*" is indicated, and seven orthographic epithet corrections are listed

Key words—*Entolomataceae*, taxonomy, classification

Introduction

In my publication on the entolomatoid fungi (Largent 1994), some errors in nomenclature and in typing were brought to my attention by several recent correspondences from Scott Redhead, Robert Fogel, Shaun Pennycook, Lorelei Norvell, Steve Trudell, and Buck McAdoo. The necessity of resolving these errors finally became apparent to me.

The nomenclatural omissions and orthographic errors rectified here involve six genera: *Calliderma*, *Clitopiloides*, *Fibropilus*, *Inocephalus*, *Leptonia*, *Nolanea*, and *Trichopilus*.

The multigeneric approach in the classification of the *Entolomataceae* is utilized in this paper as it was in Largent (1994) for the following reasons: a) the basionym for nearly every genus in the 1994 book is identical to the infrageneric basionyms in Romagnesi & Gilles (1979), Noordeloos (1992, 2004), or Noordeloos & Gates (2012); b) some exceptional agaricologists, such as C.H. Peck (1895), P.D. Orton (1991), and T.J. Baroni (2017) have recognized multigenera within the entolomatoid fungi; c) visually it is not difficult in the field to recognize the morphological groups that are represented by valid generic names; d) many, but not all, of these entolomatoid multigenera have a phylogenetic basis (Karstedt & al. 2019).

Materials and methods

Herbarium Codes were determined after consulting the Index Herbariorum web page (http://sweetgum.nybg.org/science/ih); the correct code is listed between parentheses and the incorrect code as found in Largent (1994) is listed with the code crossed out between quotation marks. The codes for the following herbaria may have errors: New York Botanic Garden Steere Herbarium (NY) "~~NYBG~~", Humboldt State University Fungal Herbarium (HSC) "~~HSU~~", San Francisco State H.D. Thiers Herbarium (SFSU) "~~SFSC~~", Virginia Polytechnic Institute and State University (VPI) "~~VPISU~~", and the University of Washington in Seattle (WTU) "~~WASH~~".

After 2002, all collection numbers designated as either DLL, dll, or (rarely) L in Largent (1994) have been conserved in the New York Botanic Garden Steere Herbarium (NY).

Taxonomy

Basionym types not transferred to new genera

The three genera *Calliderma*, *Clitopiloides*, and *Fibropilus* were validly published in 1994 as stat. nov. based on infrageneric names; their basionym type species were extraterritorial (in the context of the 1994 monograph) and were therefore not recombined in the new genera. The valid publication of the genera is presented again here together with new combinations of their type species.

Calliderma (Romagn.) Largent, Entolomatoid fungi of the western United States and Alaska: 31 (1994).

IF 27566

≡ *Rhodophyllus* section *Calliderma* Romagn., Bull. Mens. Soc. Linn., Lyon 43: 329 (1974).

Type: *Rhodophyllus callidermus* Romagn. [≡ *Entoloma callidermum* (Romagn.) Noordel. & Co-David; ≡ *Calliderma callidermum* (Romagn.) Largent].

Calliderma callidermum (Romagn.) Largent, **comb. nov.**

MB 833252

≡ *Rhodophyllus callidermus* Romagn., Bull. Jard. bot. État Brux. 26: 171 (1956).

≡ *Entoloma callidermum* (Romagn.) Noordel. & Co-David, in Co-David, Langeveld & Noordeloos, Persoonia 23: 165 (2009).

Clitopiloides (Romagn.) Largent [as "*Clitopiloidea*"], Entolomatoid fungi of the western United States and Alaska: 30 (1994).

MB 838125

≡ *Rhodophyllus* sect. *Clitopiloides* Romagn., Fondem. Taxinom. Rhodophylle: 55. (1978) [≡ Beih. Nova Hedwigia 59: 71. (1979)]

Type: *Rhodophyllus cyathus* Romagn. & Gilles [≡ *Entoloma cyathus* (Romagn. & Gilles) Noordel. & Co-David; ≡ *Clitopiloides cyathus* (Romagn. & Gilles) Largent].

Clitopiloides costata (Fr.) Largent, **comb. nov.**

MB 838130

≡ *Agaricus pascuus* β *costatus* Fr., Syst. Mycol. 1: 206 (1821)

≡ *Entoloma costatum* (Fr.) P. Kumm., Führ. Pilzk.: 98 (1871).

Clitopiloides cyathus (Romagn. & Gilles) Largent, **comb. nov.**

MB 838131

≡ *Rhodophyllus cyathus* Romagn. & Gilles, Beih. Nova Hedwigia 59: 617 (1979).

≡ *Entoloma cyathus* (Romagn. & Gilles.) Noordel. & Co-David, Persoonia 23: 167 (2009).

Comments: Although *Clitopiloides* was validly published in Largent (1994), the protologue contained several correctable errors: (1) the name "*Clitopiloidea*" required correction to *Clitopiloides*, to correspond with Romagnesi's basionym epithet (the two orthographies are synonymous but have different derivations); (2) the basionym reference was ambiguous, because the Romagnesi (1978) preprint extract from Beihefte zur Nova Hedwigia 59 was independently paginated, and p. 55 of the extract equates with p. 71 of the full volume (Romagnesi & Gilles 1979); (3) the generic type was erroneously stated to be "*Entoloma costatum*" (an error introduced by Noordeloos 1992: 212), whereas the correct type remains that designated for the basionym by Romagnesi (1978).

Fibropilus (Noordel.) Largent, Entolomatoid fungi of the western United States and Alaska: 32 (1994)

IF 27588

≡ *Entoloma* subgenus *Fibropilus* Noordel., *Entoloma* in North America Cryptogamic Studies 2: 12 (1988).

Type: ≡ *Entoloma fumosifolium* Hesler [≡ *Fibropilus fumosifolius* (Hesler) Largent]

Fibropilus fumosifolius (Hesler) Largent, **comb. nov.**

MB 833269

≡ *Entoloma fumosifolium* Hesler, Beih. Nova Hedwigia 23: 132 (1967).

Nomenclatural novelties

Inocephalus appressus Largent, **sp. nov.**

MB 833283

"*Inocephalus appressus*" Largent, Entolomatoid fungi of the western United States and Alaska: 400 (1994), nom. inval. [ICN (Shenzhen) Art. 40.7].

Type: USA, Washington State, Pierce County, Longmire Campground, scattered to gregarious in needle humus alongside a stream, 10 October 1966, DLL 1830 (**Holotype**, NY).

Etymology—from Latin *appressus* meaning closely flattened down (= adpressed/appressed fibrillose pileus surface.

Description & Illustrations: Largent (1994: 400; Figs. p. 401; Plate p. 484).

Leptonia cyanea (Sacc.) Largent, **comb. nov.**

MB 833270

≡ *Agaricus cyaneus* Peck, Bull. Buffalo Soc. Nat. Sci. 1(2): 49. 1873, nom. illegit. [non Bull. 1784].

≡ *Entoloma cyaneum* Sacc., Syll. Fung. 5: 692. 1887.

"*Leptonia cyanea*" Mazzer, in Largent, Biblioth. Mycol. 55: 66. 1977, nom. inval. [ICN (Shenzhen) Art. 36.1(a)].

Comments: *Agaricus cyaneus* Peck was published in 1873 as a valid, but illegitimate later homonym of *A. cyaneus* Bull. It was transferred to *Entoloma* by Saccardo as *E. cyaneum* nom. nov., and consequently, *Entoloma cyaneum* (Murrill) Hesler 1967 is an illegitimate later homonym. Following ICN (Shenzhen) Art. 11.4, the earliest available legitimate name for this species, *Entoloma cyaneum* Sacc., must be used as the basis of the correct name.

Leptonia cyanea var. ***occidentalis*** Largent, **var. nov.**

MB 833311

"*Leptonia cyanea* var. *occidentalis*" Mazzer, in Largent, Biblioth. Mycol. 55: 68. 1977, nom. inval. [ICN (Shenzhen) Art. 36.1(a)].

Type: USA, California State, Humboldt County, Big Hill Road east from Hoopa, scattered on conifer logs and rotting wood, October 26, 1990, DLL 9018 (**Holotype**, NY).

Etymology—From the Latin *occidentalis* meaning west, western.

Description & Illustrations: Largent (1994: 36–37; Figs. p. 37; Plate p. 469).

Nolanea papillatoides (Mešić & Tkalčec) Largent, **comb. nov.**

MB 833314

≡ *Nolanea pseudopapillata* Largent, Entolomatoid fungi of the western United States and Alaska: 243 (1994), nom. illegit. [non Pegler1983].

≡ *Entoloma papillatoides* Mešić & Tkalčec, in Mešić, Tkalčec, Kušan & Matočec, Phytotaxa 289(3): 298 (2016).

Nolanea undatomarginata (Mešić & Tkalčec) Largent, **comb. nov.**

MB 833271

≡ *Nolanea undulata* Largent, Entolomatoid fungi of the western United States and Alaska: 232 (1994), nom. illegit [non Velen. 1921].

≡ *Entoloma undatomarginatum* Mešić & Tkalčec, in Mešić, Tkalčec, Kušan & Matočec, Phytotaxa 289(3): 299 (2016).

Invalid name correction

The citation listed below should replace the invalid name listed in Largent (1994).

Leptonia violacea (Kauffman) Largent ex Redhead, Mushroom, The Journal of Wild Mushrooming 13(4): 31 (1995)

≡ *Nolanea coelestina* var. *violacea* Kauffman, Report Mich. Acad. Sci. 10: 67 (1908).

≡ *Rhodophyllus coelestinus* var. *violaceus* (Kauffman) A.H. Sm., Mushrooms in their natural habitats: 449 (1949).

≡ *Entoloma kauffmanii* Malloch, Fleshy fungi (*Basidiomycota*) of the Atlantic Maritime Ecozone: 120 (2010).

"*Leptonia violacea*" (Kauffman) Largent, Entolomatoid fungi of the western United States and Alaska: 46 (1994), nom. inval. [ICN (Shenzhen) Art. 41.5, incomplete basionym reference].

Orthographic variant corrections

The citations listed below should replace those on the indicated pages in Largent (1994). The name in quotation marks is the orthographic variant.

Calliderma indigoferum (Ellis) Largent [as "*indigofera*" in Entolomatoid fungi of the western United States and Alaska: 31 (1994)].

Leptonia acutoumbonata Largent [as "*acuto-umbonata*" in Entolomatoid fungi of the western United States and Alaska: 142 (1994)].

Leptonia chalybea (Pers.) P. Kumm. [as "*chalybaea*"] Führ. Pilzk.: 96 (1871) and in Entolomatoid fungi of the western United States and Alaska: 120 (1994)].

Leptonia chalybea var. ***squamulosipes*** Largent [as "*chalybaea*" in Entolomatoid fungi of the western United States and Alaska: 120 (1994)].

Leptonia roseicinnamomea Largent [as "*roseicinnamonea*" in both Northwest Sci. 48: 59 (1974) and Entolomatoid fungi of the western United States and Alaska: 85 (1994)].

Nolanea brunneolamellata Largent [as "*brunneo-lamellata*" in Entolomatoid fungi of the western United States and Alaska: 249 (1994)].

Nolanea substrictior Largent [as "*substrictia*" in Entolomatoid fungi of the western United States and Alaska: 274 (1994)].

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Quadracaea mediterranea, a new record from Kumaun Himalaya region, India

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Abstract—*Quadracaea mediterranea* was collected during our continuing mycological survey of saprobic conidial fungi on decaying leaf litter of *Quercus floribunda* from the Ramgarh forest, Nainital, Uttarakhand, India. Detailed taxonomic information on *Q. mediterranea* includes morphological description, geographical distribution, comments, illustrations, and a comparison with allied taxa. This finding extends the geographic distribution of the species, previously recorded only in China, Italy, and Brazil.

Key words—anamorphic fungi, cellotape technique, hyphomycetes, plant debris, saprobic

Introduction

Quadracaea was established by Lunghini & al. (1996), for a single species, *Q. mediterranea*. Subsequently, two additional species were described, *Q. roureae* Y.D. Zhang & X.G. Zhang and *Q. stauroconidia* F.R. Barbosa & Gusmão (Zhang & al. 2012, Barbosa & al. 2013). *Quadracaea* species are characterized by macronematous mononematous straight thick-walled septate conidiophores, integrated terminal and intercalary polyblastic conidiogenous cells producing groups of ampulliform separating cells, blastic solitary conidia, each bearing a frill at the base, with rhexolytic conidial secession, and occurrence of a synanamorph (Lunghini & al. 1996, Zhang & al. 2012,

Barbosa & al. 2013). Conidiophore branching and size, conidial shape, and presence of lateral cells are important diagnostic characters for *Quadracaea* spp. The species are thought to be saprophytic and have been discovered on rotten wood, branches, twigs, bark, and leaves of various trees and shrubs or on decaying herbaceous materials in both freshwater and terrestrial habitats.

Based on the presence of a synanamorph and rhexolytical conidial secession, *Uberispora* Piroz. & Hodges and *Physalidiopsis* R.F. Castañeda & W.B. Kendr. are considered to be the closest related genera to *Quadracaea* (Pirozynski & Hodges 1973, Castañeda-Ruiz & Kendrick 1990). However, *Uberispora* does not produce separating cells and displays a different arrangement of satellite cells around the central conidial cell (Pirozynski & Hodges 1973, Castañeda-Ruiz & al. 1996). *Physalidiopsis* differs from *Quadracaea* primarily by producing short branches on the conidiophores (Castañeda-Ruiz & Kendrick 1990). The presence of stauroconidia in *Physalidiopsis* was used as a major character by Lunghini & al. (1996) to distinguish it from *Quadracaea*.

Knowledge on the occurrence and diversity of *Quadracaea* is limited. During ongoing surveys of saprobic microfungi from Ramgarh forest, Nainital, Uttarakhand, India, an interesting anamorphic fungus was collected from leaf litter. This fungus was identified as *Quadracaea mediterranea* and is described and illustrated as a new record for India.

Materials & methods

Samples of plant debris including leaves, twigs and bark were collected at random from different parts of Ramgarh forest of Nainital (29°26′49″N 79°33′35″E), Uttarakhand, India, during the winter months (January–February) of 2013, placed in plastic bags and transported to the laboratory. The plant materials were incubated in moist chambers at 25°C and examined with a stereomicroscope, over a two-week period, for the presence of dematiaceous hyphomycetes. When interesting fungi were seen, slides were prepared using a cellotape technique as described by Dubey & al. (2018, 2019). All microscopic characteristics were examined, measured, and photographed using light microscopy.

A microscope slide containing the reproductive structures of *Quadracaea*, which was found on decaying leaves of *Quercus floribunda,* was deposited in the Herbarium of the Indian Agricultural Research Institute, New Delhi, India (IARI).

Taxonomy

Quadracaea mediterranea Lunghini, Pinzari & Zucconi,
Mycotaxon 60: 104, 1996. Fig. 1

Colonies on natural substratum amphigenous, irregularly effuse, dark brown to blackish, hairy, loosely dispersed often producing only scattered

Fig. 1. *Quadracaea mediterranea* (IARI HCIO 52003) from oak leaf litter. A, B. Conidia attached to conidiophore; C. Conidia with darker central cells and phialoconidia (arrow); D. Details of the ampulliform separating cells (arrow); E. Proliferating separating cells (arrow); F. Conidia attached to conidiophore via separating cells; G. Conidia with apical synanamorphic phialoconidia (arrow).

conidiophores with a dark lobate base. Mycelium partly immersed and partly superficial in the substratum; hyphae branched, septate, smooth-walled, light brown to yellowish brown, 2–5 µm diam. Conidiophores mononematous, macronematous, simple, erect, 5–(6)–8 septate (septa thin), cylindrical, usually solitary or in groups of two or four, mid to dark yellowish brown, mainly subhyaline or paler towards the apex, smooth, thick-walled, 82–(130)–150 µm long, 8–10 µm diam. at the lobate base, 6–8 µm diam. in the middle, tapering gradually towards the rounded apex, sometimes with percurrent regenerations. Conidiogenous cells polyblastic, sympodial, concolorous with the separating cells, more or less sub-cylindrical or cylindrical, 6–9 µm long, 3–6 µm diam., integrated into the apical region of conidiophores, terminal but becoming intercalary by percurrent proliferations which arise by extension of the basal septum of the apical/terminal separating cell into and beyond it. Separating cells in clusters (≤10) or single, thin-walled, smooth, 4–8 µm long, 1.5–3.0 µm diam., concolorous with the conidiophore, ampulliform, usually tapered at the apex, empty, leaving an open end after rhexolytic conidial secession (Fig. 1D); sometimes it may proliferate percurrently at the tip growing through the scar of the fallen conidium to produce a lateral

branch, growing for a length of up to 25–40 µm before producing more conidia (Fig. 1E). Conidia produced singly, acropleurogenous, versicolored, suboval or obpyriform to broadly-fusiform or lemoniform, with 3 transverse septa, smooth, dry, 20–(26)–30 µm long, 8–(10)–12 µm thick at the broadest point, sometimes slightly constricted at septa; second cell broadest, fusoid, largest, thick-walled with most conspicuous broad black bands at the septa, darker than the others; third or penultimate cells dark to pale brown, smaller, and thick-walled; apical cell hyaline to subhyaline, smallest, thin-walled, narrowly conical with pointed apex, bearing 2–4 conspicuous, prominent subconical elongations producing phialoconidia, each up to 5–8 µm long and 0.6–1.5 µm diam. (Fig. 1F, G). Basal cell small, slightly thick-walled, funnel-shaped, smooth, pale brown or subhyaline, bearing a conspicuous frill at the base. Synanamorphic phialoconidia blastic, hyaline, smooth, thin-walled, aseptate, fusiform, slightly falcate and produced apically in a *Selenosporella*-like manner.

Specimen examined: **INDIA, Uttarakhand, Nainital**, Ramgarh forest, on decaying leaves of *Quercus floribunda* Lindl. ex A. Camus (*Fagaceae*), 16 January 2013, coll. Gupta BKU 122 (IARI HCIO 52003).

Distribution: Brazil (Santa Izabel & Gusmão 2018), China (Wu & Zhuang 2005), Italy (Lunghini & al. 1996), India (this report).

Comments: Our specimen represents the first record of this species for India. The Indian specimen closely matches the original description of *Q. mediterranea* (Lunghini & al. 1996), except that our Indian material had proliferating separating cells, slightly larger conidia, and smaller conidiophores.

Quadracaea mediterranea is easily distinguished from other species of the genus by its distinct conidiophores and conidial morphology. *Quadracaea roureae* and *Q. stauroconidia* have branched conidiophores and conidia without lateral cells. The conidia of the former usually contain up to 2 lateral cells whereas in later the conidia comprises mainly 2 (or rarely 1) lateral cells. The conidia of *Q. roureae* are predominantly obpyriform, while *Q. stauroconidia* produces stauriform conidia with one dark, angular central cell and satellite cells around it (Barbosa & al. 2013). *Quadracaea mediterranea* has been reported on leaf litter of *Quercus ilex* L. (Lunghini & al. 1996) and decaying leaves of unidentified plants (Wu & Zhuang 2005, Santa Izabel & Gusmão 2018). *Quadracaea roureae* has been found on dead branches of *Rourea minor* (Gaertn.) Alston (*Connaraceae*; Zhang & al. 2012) and *Q. stauroconidia* on submerged leaves/twigs of tropical plants (Barbosa & al. 2013). This record of *Q. mediterranea* in the high altitude of India's Central

Himalayas extends its geographic distribution and emphasizes the ecological importance of the Kumaun Himalaya region as an important center for conservation of rare fungal species.

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Corynespora sinensis sp. nov. from Jiangxi, China

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Abstract—A new asexual fungus, *Corynespora sinensis*, is described and illustrated. It was found on dead branches of unidentified plants in Jiangxi Province, China, and is characterized by its smooth ellipsoid, obclavate, or fusiform 3(–4) distoseptate conidia produced in simple chains of 2. A synopsis of *Corynespora* species described since 2010 is provided.

Key words—anamorphic fungi, *Corynesporaceae,* hyphomycetes, saprobes, taxonomy

Introduction

Corynespora Güssow, established by Güssow (1905), was emended by Wei (1950), who provided an historical review and described *C. cassiicola* (Berk. & M.A. Curtis) C.T. Wei [= *C. mazei* Güssow, the type species]. The genus is characterized by distinct conidiophores with monotretic integrated terminal determinate or percurrently extending conidiogenous cells that produce solitary (or rarely catenate) distoseptate phragmoconidia (Wei 1950, Ellis 1971, Seifert & al. 2011). Siboe & al. (1999) provided a synopsis of relevant morphological features that distinguish 50 accepted *Corynespora* species but did not include *C. kenyensis* Siboe & al. McKenzie (2010) subsequently published a synopsis of the main morphological features of 61 different species. Since then

27 additional species have been added to the genus (Index Fungorum 2019). However, *Corynespora cespitosa* (Ellis & Barthol.) M.B. Ellis (Ellis 1963), *C. endiandrae* Crous & Summerell (Crous & al. 2014), *C. leucadendri* Quaedvl. & al. (Quaedvlieg & al. 2013), and *C. olivacea* (Wallr.) M.B. Ellis (Ellis 1960) were accepted as *Helminthosporium* species by Voglmayr & Jaklitsch (2017) based on morphological and phylogenetic analyses. "*Corynespora aeria*" K. Swapna & N.N. Nair (Swapana & Nair 2015) and "*C. ipomoeae*" N. Verma & al. (Verma & al. 2014) are invalid (no identifier number cited; Turland & al. 2018: Art. F.5.1) and "*C. masseeana*" (Teng) P.M. Kirk (Kirk 2014) is also invalid (lacking a full and direct basionym reference; Turland & al. 2018: Art. 41.1).

During ongoing surveys of saprophytic microfungi associated with plant debris in southern China, an interesting hyphomycete with monotretic conidiogenous cells that produce smooth distoseptate ellipsoid, obclavate, or fusiform conidia in simple chains of 2 was collected on dead branches. Morphologically typical of *Corynespora,* the fungus differs from previously described taxa and therefore is proposed as new to science. With the addition of the new species, a synopsis of the main morphological features of *Corynespora* species described since McKenzie (2010) is presented in Table 1, following the same format as McKenzie.

Materials & methods

Dead branches were collected from humid environments and watersides in the forest ecosystems of southern China and placed in Ziploc™ plastic bags for transport to the laboratory, where they were processed and examined according to Ma & al. (2011). Microphotographs were prepared using a Nikon Eclipse E200 and SmartV550Dc digital camera, with a 100 × (oil immersion) objective. Conidia were measured at their widest point. The range between minimum and maximum values for microscopic measurements is given with outliers in parentheses. Adobe Photoshop 7.0 was used for image processing to assemble photographs into plates. The specimens are deposited in the Herbarium of Jiangxi Agricultural University, Plant Pathology (HJAUP), Nanchang, Jiangxi, China.

Taxonomy

Corynespora sinensis Jian Ma, X.G. Zhang & R.F. Castañeda, **sp. nov.** Fig. 1

MB 833230

Differs from *Corynespora myrioneuronis* by its ellipsoid, obclavate or fusiform, wider conidia produced in simple chains of 2 by non-extending conidiogenous cells.

Type: China, Jiangxi Province, Jinggangshan Mountain, on dead branches of an unidentified broadleaf tree, 5 November 2014, J. Ma (**Holotype**, HJAUP M0156).

Etymology: referring to the country in which the fungus was collected.

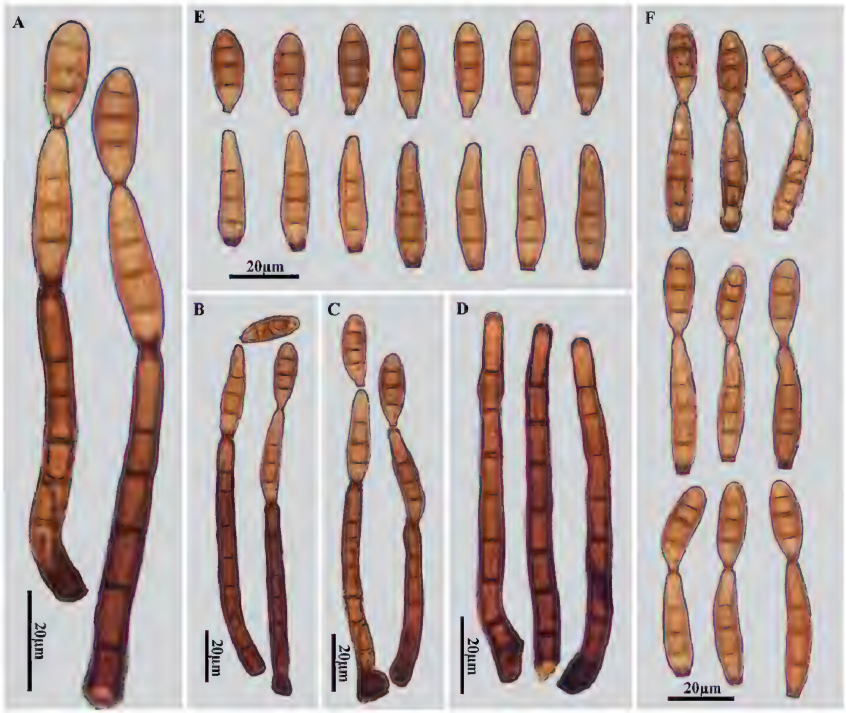

Fig. 1. *Corynespora sinensis* (holotype, HJAUP M0156).
A–C. Conidiophores, conidiogenous cells, and conidia; D. Conidiophores; E, F. Conidia.

Colonies on the natural substratum, effuse, dark brown. Mycelium partly superficial, partly immersed; hyphae branched, septate, pale brown, smooth-walled. Conidiophores macronematous, mononematous, unbranched, erect, straight or flexuous, cylindrical, smooth, brown to dark brown, 4–8-septate, 53–96.5 × 7–8.5 μm. Conidiogenous cells monotretic, integrated, terminal, determinate, cylindrical, brown, smooth, 11.5–18 × 6–7 μm. Conidial secession schizolytic. Conidia acrogenous, dry, in simple chains of 2, smooth-walled, brown; primary conidia obclavate or fusiform, 3(–4)-distoseptate, 31.5–42 × 8–9.5 μm, 5–6 μm diam. near the apex, 3.5–4.5 μm diam. at the truncate base; secondary conidia ellipsoid, 3-distoseptate, 21–28.5 × 8–9.5 μm, apex rounded, base truncate, 2.5–3 μm diam.

Additional specimens examined: **CHINA, Jiangxi Province, Jinggangshan Mountain**, on dead branches of an unidentified broadleaf tree, 5 November 2014, J. Ma (HJAUP M0168); **Lushan Mountain**, on dead branches of an unidentified broadleaf tree, 8 November 2014, J. Ma (HJAUP M0179).

Table 1. Major morphological features of *Corynespora* species described since McKenzie (2010)

Species	Conidia					Host/ substratum
	Production	Morphology	Colour	Size (µm)	Septation	
"*aeria*"	Solitary	Obclavate	Subhyaline to olivaceous	≤350 × 2–5	1–5	Air, India
annonacea	Solitary or catenate	Obclavate to obclavate-cylindrical	Subhyaline to olivaceous brown	25–135 × 10–18	1–10	*Annona squamosa*, India
bombacina	Solitary or catenate	Obclavate-cylindrical	Light olivaceous	45–180 × 10–16	5–15	*Bombax ceiba*, India
carrisae	Solitary	Obclavate-cylindrical	Olivaceous to very light brown	75–242 × 6–14	4–17	*Carissa spinarum*, India
celastri	Solitary	Obclavate to obclavate-cylindrical	Olivaceous to very light brown	55–120 × 8–15	7–17	*Celastrus paniculatus*, India
clerodendrigena	Solitary or catenate	Obclavate-cylindrical	Light olivaceous	60–220 × 16–22	3–13	*Clerodendrum viscosum*, India
encephalarti[2]	Solitary	Obclavate	Medium olivaceous brown	100–150 × 11–15	1–12	*Encephalartos*, South Africa
ficigena	Solitary	Obclavate-cylindrical	Light olivaceous brown	90–165 × 9–20	7–13	*Ficus religiosa*, India
fujianensis	Solitary	Obclavate	Brown	31–90 × 6.5–10	4–10	*Myrioneuron faberi*, China
holopteleicola	Solitary	Obclavate to obclavate-cylindrical	Olivaceous brown	33–148 × 5–20	0–11	*Holoptelea integrifolia*, India
"*ipomoeae*"	Solitary or catenate	Obclavate to cylindrical	Subhyaline to pale olivaceous	40–380 × 5–15	2–35	*Ipomoea obscura*, India
"*masseeana*"	Solitary	Elongate-obclavate	Pale olivaceous	80–120 × 18–20	7–11	*Helicteres*, India
moracearum	Solitary	Obclavate-cylindrical	Light olivaceous brown	27–163 × 12–20	5–16	*Ficus hispida*, India

palmicola	Solitary	Obclavate-subcylindrical	Pale brown	40–70 × 6–9	5–7	*Syagrus romanzoffiana*, Paraguay
peristrophicola	Solitary	Obclavate to obclavate-cylindrical	Olivaceous to very light brown	60–135 × 5–16	5–12	*Peristrophe bicalyculata*, India
pogostemonicola	Solitary	Obclavate to obclavate-cylindrical	Olivaceous to olivaceous brown	77–288 × 8–14	5–24	*Pogostemon plectranthoides*, India
pongamiicola	Solitary	Obclavate, ellipsoidal, clavate or club-shaped	Light olivaceous yellow	18–65.2 × 8–16.5	1–6	*Pongamia pinnata*, India
pseudocassiicola[2]	Solitary	Subcylindrical to obclavate	Medium brown	95–160 × 9–10	(4–)8–12 (–17)	*Byrsonima*, Colombia
sidae	Solitary	Obclavate to obclavate-cylindrical	Olivaceous to very light brown	25–220 × 7–17	2–24	*Sida acuta*, India
sinensis	Catenate	Obclavate or fusiform, ellipsoid	Brown	21–42 × 8–9.5	3(–4)	Dead branches, China
thailandica[2]	Mostly solitary	Obclavate	Brown	80–110 × 10–12	4–8	Wood, Thailand
thorii	Catenate	Subcylindrical, broadly ellipsoid to almost obovoid	Pale to medium olivaceous-brown	20–30 × 5–7	(0–)1(–3)	Thallus, apothecia of *Lecanora*, Japan
titarpaniensis[1]	Solitary	Obclavate-cylindrical	Olivaceous to light brown	50–340 × 5–20	5–35	*Lepidagathis*, India
tomenticola	Solitary	Cylindrical	Olivaceous to olivaceous brown	50–230 × 10.5–20.5	3–6	*Terminalia tomentosa*, India,
torulosa	Solitary	Clavate	Dark olivaceous	35–60 × 13–20	3–5	*Musa cavendishii*, Brazil and Mexico
tremae	Solitary	Obclavate to obclavate-cylindrical	Light brown to brown	50–160 × 4–12	5–20	*Trema orientalis*, India

[1]All conidiophores are mononematous and non-stromatic, except for *C. titarpaniensis,* which is stromatic.

[2]All conidia are smooth, except for *C. pseudocassiicola* and *C. thailandica*, which are finely roughened and *C. encephalarti* which are not indicated.

Comments—About 43 *Corynespora* species produce solitary or catenate conidia (Siboe & al. 1999, McKenzie 2010, Table 1), but *C. sinensis* can be distinguished from other species by the shape, size, and septation of its primary and secondary conidia. *Corynespora sinensis* is most similar to *C. myrioneuronis* Jian Ma & X.G. Zhang (Ma & Zhang 2007) in producing 3–4-distoseptate conidia, but *C. myrioneuronis* is characterized by solitary obclavate narrower (6.5–8 μm diam.) conidia on extending conidiogenous cells.

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First record of *Camarops petersii* from eastern Europe

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Abstract—The stromatic ascomycete *Camarops petersii* was recorded for the first time in Eastern Europe. It was found growing on *Quercus robur* wood, on a fallen trunk of a lightning stuck tree in Bryansk Oblast, next to the western border of Russia. The morphological description, data on the distribution and habitat are provided. The modern distribution of *C. petersii* is confined mostly to the refugia of tertiary relict floras. All known European populations of *Camarops petersii* (including our own) are from north of the Alps, possibly established relatively recently due to post-glacial colonization of the broadleaf forests. Future *C. petersii* populations may be found in the Mediterranean area and the Caucasus.

Key words—*Boliniaceae*, *Boliniales*, fungal ecology, mycogeography, *Sordariomycetes*

Introduction

Camarops P. Karst. (*Boliniaceae*, *Boliniales*) is a genus of stromatic *Sordiariomycetes* characterized by massive, erumpent, usually dark colored and carbonized stromata, evanescent paraphyses and asci, and relatively small, brown-colored, non-septate ascospores with a germ pore (Nannfeldt 1972). The genus includes 25 species according to Index Fungorum (2019).

Camarops petersii is well distinguished from all other species of the genus because the immature stroma is covered by a thick, membranaceous veil-like structure that breaks down later except at the margin. The species was originally described based on two collections from Alabama, (USA) and Cuba (Berkeley 1868) and for a long time was believed to occur only in the western hemisphere until it was discovered in Korea in 1930 (Iwade 1944) and later in Germany (Nuss & Hilber 1977).

In the present paper, we discuss the first record of *Camarops petersii* in eastern Europe based on a collection made by the second author during a survey of wood-inhabiting fungi in Bryansk Oblast (Russia).

Material & methods

The field survey was organized by the second author in August 2018 during a multi-year survey of the wood-inhabiting fungi of the Non-Chernozem Zone of Russia (Popov 2013, Volobuev 2013, Popov & Volobuev 2014). Voucher specimens were deposited in the Mycological Herbarium of the Komarov Botanical Institute of the Russian Academy of Sciences, Saint Petersburg, Russia (LE).

Global distribution data for *Camarops petersii* was taken from literature and the Global Biodiversity Information Facility portal (GBIF 2019), which cited 112 occurrences on 7 April 2019.

The description of macroscopic characters was based on fresh and dry material and photographs in situ. Microscopic features were observed and measured from dried material squash mounted in tap water for light microscopy (Zeiss Axio Imager A1 microscope). Melzer's reagent (MLZ) was used to check the amyloid reaction of hymenial structures. Dimensions of spores were derived from 20 measures. The images of microstructures were captured with an AxioCam MRc 5 digital camera on the microscope equipped with bright-field and differential interference contrast (DIC) optics. Images were edited by using AxioVision SE64 ver. 4.9.1 software.

DNA extraction, amplification, and sequencing followed Zmitrovich & al. (2019). The fungal specific primers ITS1F and ITS4 were used to sequence the ITS rDNA gene region (White & al. 1990, Gardes & Bruns 1993).

Taxonomy

Camarops petersii (Berk. & M.A. Curtis) Nannf.,
Svensk Bot. Tidskr. 66(4): 366 (1972). Pl. 1

Stromata superficial on wood, individual, 3–5 cm in diam, ≤1 cm high, flattened-turbinate to discoid, centrally attached, woody, dull brown in cross section, initially wrapped in a whitish, brown flecked veil, which irregularly cracks and breaks down when mature to expose a black and shiny stromatal surface; perithecia immersed in the upper part of stromata at different depth (polystichous), obclavate, 1–1.5 × 0.4–0.5 mm, with long necks ending in papillate ostioles.

Asci 52–65 × 4.8–6.3 µm, cylindrical, stipitate, with an inamyloid apical ring, 8-spored, evanescent and often absent in fully mature perithecia; ascospores 6.0–8.4 × 3.3–4.5 µm, uniseriate, 1-celled, ellipsoid to obovate, slightly pointed at one end, olive brown, with two large lipid drops and a germ pore at the

Plate 1. *Camarops petersii* (LE 323478). A. Fresh mature stroma *in situ* showing disrupted veil and exposed stromatal surface; B. Stroma in cross section with polystichous perithecia in upper part; C. Ascospores (position of germ pore marked with an asterisk). Scale bars: A, B = 1 cm; C = 5 µm.

tapered end; paraphyses cylindrical, 1.5–2 µm diam., hyaline, septate, longer than asci and evanescent.

Material examined: **RUSSIA**, **Bryansk oblast**: **Suzemskiy district**, Nerusso-Sevnyi protected forest area, 'Rybnitsa' natural boundary, 52°24′32″N 34°05′00″E, floodplain, oak-dominated deciduous forest with *Quercus robur*, *Acer platanoides*, *Fraxinus excelsior*, on decorticated trunk of *Q. robur* lying on the ground, 30 August 2018, coll. S. Volobuev (LE 323478; GenBank MN564897).

Discussion

Camarops petersii grows on fallen and usually decorticated logs of *Quercus* spp, more rarely of *Castanea*, *Castanopsis*, and *Zelkova* (Nannfeldt 1972, Nuss & Hilber 1977, Doi & Nunomura 1980). Our collection was also found on wood of a barkless, recently fallen trunk that was about 60 cm in diam, and comparatively hard (a knife could not penetrate more than 2–3 cm in depth).

Camarops petersii appears to be widely distributed in North America, where it has been frequently reported from broadleaf forests of the Appalachians and Central Lowlands west to Kansas and as far north as Vermont and Wisconsin (Ellis & Everhart 1888, Shear 1923, Heagle & French 1972, Nannfeldt 1972, Fergus 1973, Horn 1984, Vasilyeva & al. 2007). Moreover, 77 of 112 occurrences of this species in the GBIF portal are from North America (GBIF 2019).

Infrequent findings have been reported from temperate broadleaf and mixed forests in Asia: South Korea (Iwade 1944), Russian Far East (Nannfeldt 1972), Japan (Doi & Nunomura 1980), Taiwan (GBIF 2019), northern Iran (Arefipoor & al. 2018), and northwestern Himalayas (Dargan 1976; Dargan & Thind 1984); and in Europe, from Germany, Austria, and France (Nuss & Hilber 1977, Urban 2016, MycoDB 2019). The modern disjunct distribution of *C. petersii* is thus confined mostly to the refugia of tertiary relict floras as defined by Milne & Abbott (2002).

In Europe, during most of the last glacial period, the temperate forest species, including summer-green species of the *Quercus*, were restricted to small refugia. Those were situated mostly south of 45°N along the Mediterranean coast and around the Black and Caspian Seas (Leroy & Arpe 2007, Svenning & al. 2008, Tzedakis & al. 2013). At that time, most of the area north of the Alps was covered with tundra and cold steppes (Gerasimov & Velichko 1982, Binney & al. 2017). The spread of deciduous *Quercus* species from these refugia to the Central European mountains took place in the late-glacial interstadial (13–11 thousand years ago), and oaks spread into Northern and Eastern Europe only in the Holocene (Brewer & al. 2002, Birks & Tinner 2016). It is likely that European populations of *Camarops petersii* were recently established as a result of post-glacial colonization of the broadleaf forests. We suppose that *C. petersii* still could be found in the Mediterranean area and the Caucasus. But this supposition needs to be verified by mycologists in those regions.

A BLAST search revealed that the ITS sequence newly generated from our material (GenBank MN564897) is identical with those of the North American collection of *C. petersii* MICH 340497 (GenBank MT913624).

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Trapelia calyciformis sp. nov. from China

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Abstract—*Trapelia calyciformis* is described from China as a new species. The lichen is characterized by its gray-white thallus, zeorine apothecium with black disc and cracked excipulum, narrow paraphyses branched near the tip, 8-spored asci, aseptate ascospores with one vacuole, and the presence of gyrophoric acid. The specimens examined were deposited in LCUF. A key to the species of *Trapelia* reported in China is presented.

Key words — lichenized fungi, *Trapeliales*, *Trapeliaceae*, taxonomy

Introduction

Trapelia was introduced by Choisy in 1929 and has about 20 species worldwide (Orange 2018). Most taxa are found on rock, rarely on soil and bark (Orange 2018, Aptroot & Schumm 2012, Kantvilas & Elix 2007). The characteristics of this genus are a crustose thallus often with areoles; apotheciate ascomata, slender non-amyloid paraphyses (often branched near the tip but rarely swollen); 8-spored subcylindrical asci with weakly thickened apices; non-septate ascospores that are ellipsoid to subglobose, hyaline, and non-amyloid; and the presence of gyrophoric acid and 5-O-methylhiascic acid (Hertel 1969, 1970; Jaklitsch & al. 2016).

In recent years, much attention has been paid to crustose lichens in China, with many new species and records reported (Aptroot & Seaward 1999; Aptroot & Sipman 2001; Aptroot & Sparrius 2003; Dou & al. 2019; Ren 2015, 2017; Ren & Zheng 2018; Ren & al. 2018; Wang & al. 2015; Yan & al. 2017; Zhou & Ren 2018). Aptroot and his colleagues have reported three species of *Trapelia*—*T. coarctata* (Turner) M. Choisy, *T. involuta* (Taylor) Hertel, and *T. placodioides*

Coppins & P. James. During our study of the genus, two specimens from Jiangxi Province, China differed from the known species and are proposed here as a new species, *T. calyciformis*.

Materials & methods

Specimens. All materials were collected from Jiangxi Province, China, and are deposited in Fungarium of the College of Life Sciences, Liaocheng University, Liaocheng, China (LCUF), and the Lichen Section, Herbarium Mycologium, Chinese Academy of Sciences, Beijing, China (HMAS-L). The macroscopic characters were examined and photographed under an Olympus SZX16 dissecting microscope. The specimens were examined microscopically and photographed under an Olympus BX53 compound microscope. Cortex and medulla were tested using K (a 10% aqueous solution of potassium hydroxide), C (a saturated solution of aqueous sodium hypochlorite), and P (a saturated solution of *p*-phenylenediamine in 95% ethyl alcohol). The lichen substances were detected using standardized thin layer chromatography techniques (TLC) (Orange & al. 2010, Jia & Wei 2016).

DNA extraction, amplification, and sequencing. Molecular protocols followed Dou & al. (2019). The ITS sequence was amplified using the ITS1F and ITS4 primers (Gardes & Bruns 1993, White & al. 1990). Thermocycling conditions were set according to Orange (2018).

The newly generated sequence was submitted to GenBank and aligned with ITS sequences of related taxa selected by a Blast search of closely related ITS sequences and comparison with morphological characters and literature as suggested by Orange (2018) (Fig. 1).

Phylogenetic analysis and sequence comparisons. The ITS sequences of the specimen and 14 selected representatives were aligned by Muscle using MEGA5 (Tamura & al. 2011). The final matrix can be obtained from the corresponding author. A phylogeny was generated using MrBayes on XsEDE (3.2.6) and RAxML-HPC2 on XSEDE (8.2.12) (Miller & al. 2010). The level of confidence in the resulting topological bipartitions was estimated with 1000 bootstrap replicates. All alignment gaps and missing data were excluded during phylogenetic analyses via pairwise sequence comparisons. Absolute distances were estimated using MEGA5, based on p-distance model with all gaps removed from each sequence pair.

Results & discussion

Sequencing & phylogenetic analysis

The partial ITS1 region, complete 5.8S ribosomal RNA gene, and partial ITS2 region of the Jiangxi sample were successfully sequenced; the sequence submitted to GenBank contained 480 base pairs. The sites that were difficult to align were removed from the matrix, and a total of 464 positions were reserved for phylogenetic analyses in the final dataset.

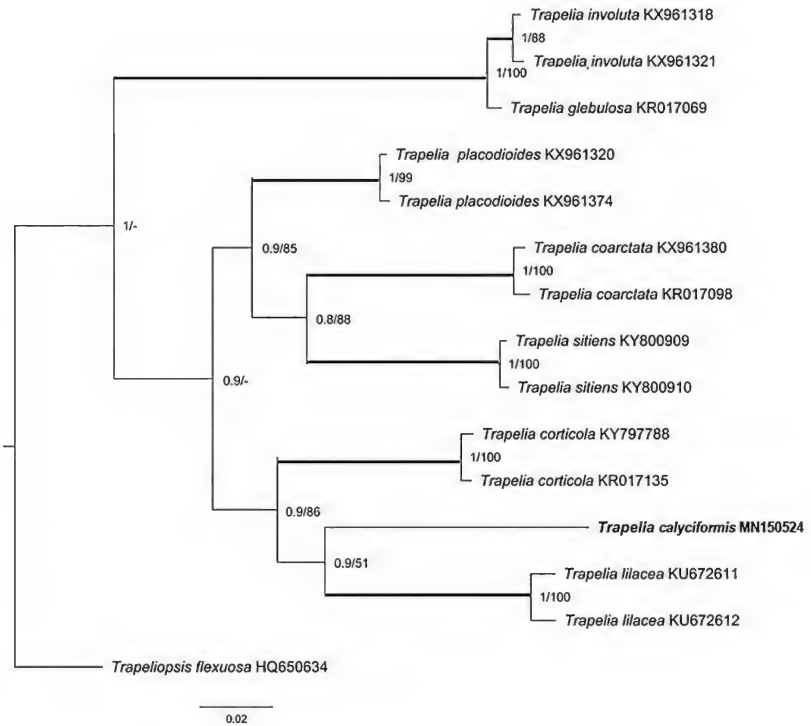

Fig. 1. Phylogenetic relationships inferred from ITS sequences of *Trapelia calyciformis* and closely related *Trapelia* species (with *Trapeliopsis flexuosa* as outgroup). The evolutionary tree was inferred by using the Bayesian method. The tree is drawn to scale, with branch lengths measured in the number of substitutions per site. Posterior probabilities/ML-bootstrap values >50% are written next to nodes. Branches highly supported by both methods (PP ≥0.95 and ML ≥70%) are indicated with a bold line.

ITS sequence analysis supported a close relationship (98.69% identity) between the new species (*T. calyciformis*) and *T. coarctata* and strongly supported the monophyly of *T. coarctata* (PP = 1; ML = 100%), *T. involuta* (PP = 1; ML = 88%), *T. placodioides* (PP = 1; ML = 99%), *T. sitiens* Orange (PP = 1; ML = 100%), *T. corticola* Coppins & P. James (PP = 1; ML = 100%), and *T. lilacea* Kantvilas & Elix (PP = 1; ML = 100%). *Trapelia. glebulosa* (Sm.) J.R. Laundon clusters together with *T. involuta* (PP = 1; ML = 100%). Our phylogenetic analysis placed the Jiangxi sequences within *Trapelia,* and weakly supported the relationship between *T. calyciformis* and its morphologically closely related species *T. lilacea* (PP = 0.9; ML = 51%) (Fig. 1).

Absolute distances for the aligned sequences of the ITS sequence also support the separation of a new species. In our sequence matrix, distances between infraspecific samples are ≤3 and between species are ≥4, while the distances between *T. calyciformis* and other species are ≥55 (Table 1).

Both molecular and morphological analyses support *T. calyciformis* as a new species.

Table 1. Absolute distances between aligned ITS sequences from *Trapelia calyciformis* and related species. (Gaps ignored in pairwise comparisons.)

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. *T. calyciformis* MN150524													
2. *T. placodioides* KX961320	60												
3. *T. placodioides* KX961374	61	**1**											
4. *T. coarctata* KX961380	65	35	36										
5. *T. coarctata* KR017098	66	36	37	**1**									
6. *T. involuta* KX961318	85	68	68	71	72								
7. *T. involuta* KX961321	85	68	68	71	72	**1**							
8. *T. lilacea* KU672611	58	54	54	55	56	80	79						
9. *T. lilacea* KU672612	55	55	56	54	55	82	81	**3**					
10. *T. glebulosa* KR017069	84	65	65	69	70	4	5	78	80				
11. *T. corticola* KY797788	56	48	49	50	51	72	72	54	53	71			
12. *T. corticola* KR017135	56	48	49	50	51	72	72	54	53	71	**0**		
13. *T. sitiens* KY800909	60	39	40	40	41	67	67	58	57	64	52	52	
14. *T. sitiens* KY800910	60	39	40	40	41	67	67	58	57	64	52	52	**0**

* Infraspecific distances are indicated with bold font.

Taxonomy

Trapelia calyciformis Z.F. Jia, **sp. nov.** Fig. 2

FN 570662

Differs from *Trapelia coarctata* by its cracked excipulum.

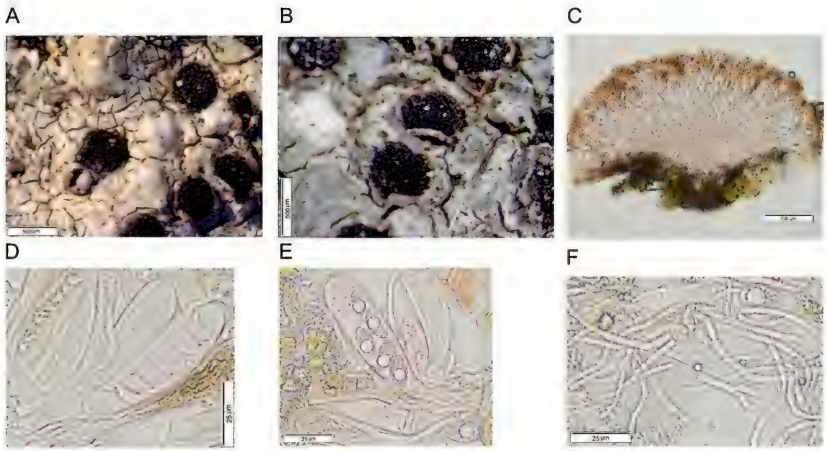

Fig. 2. *Trapelia calyciformis* (holotype, LCUF – Yao JX19016). A. Thallus with apothecia; B. Apothecia with cracked excipulum; C. Cross section of apothecium; D. Asci with thickened apex; E. Ascospores; F. Paraphyses septate and branched near the tip.

Type: China. Jiangxi: Shangrao City, Wuyuan County, Xitou Town, Jiangling Scenic Area, 29°27′N 118°01′E, alt. 392 m, on rock, 16/III/2019, Z.T. Yao JX19016 (**Holotype**, LCUF; **Isotype**, HMAS-L 0144251; GenBank MN150524).

Etymology: From the Latin *calyciformis* meaning "calyx-shaped," referring to the shape of the cracked excipulum.

Thallus crustose, saxicolous, off-white, dull. Algae chlorococcoid. Apothecia zeorine, orbicular, sessile, 0.4–0.5 mm diam.; disc convex, black, epruinose; exciple brown; epithecium brown, 21–29 µm tall; hymenium hyaline, without oil droplets, I–, paraphyses branched near the tip, 1.5–2.5 µm diam.; hypothecium light brown. Asci clavate, 80–90 × 15–17 µm, 8-spored. Ascospores 15.2–22(–28) × 7.2–10.7 µm, non-septate, ellipsoid, hyaline. Pycnidia not observed.

Chemistry: Thallus UV–, C+ red, K–, P–. Gyrophoric acid detected with TLC.

Ecology & distribution: On rocks. Known only from the type locality.

Additional specimen examined: **CHINA**. **Jiangxi**: **Shangrao City**, Wuyuan County, Xitou Town, Jiangling Scenic Area, alt. 392 m, on rock, 16/III/2019, Z.T. Yao JX19017 (LCUF).

Remarks: *Trapelia calyciformis* morphologically resembles *T. coarctata*, which differs by its white mound-like apothecia in its early stage and intact excipulum without cracks when mature (Orange 2018, Brodo & Lendemer

2015); however, *T. calyciformis* is very well separated from *T. coarctata* in ITS sequences. *Trapelia calyciformis* is also similar morphologically to *T. glebulosa,* which is distinguished by ITS sequence differences, its biatorine apothecia, and a thallus that does not appear as a single, coherent unit but instead comprises distinct areoles with abruptly thickened margins (Orange 2018; Brodo & Lendemer 2015). Despite the close relationship between *T. calyciformis* and *T. lilacea* in the ITS tree, the basal node is only weakly supported. Moreover, *T. calyciformis* differs distinctly from *T. lilacea* in morphology and chemistry: *T. lilacea* is distinguished by its wider ascospores (9–15 µm diam.), sunken concave thallus disc, and 5-O-methylhiascic acid as its primary lichen substance (Kantvilas & Elix 2007).

Key to the species of *Trapelia* known from China

1. Soralia present ..... *T. placodioides*
1. Soralia absent 2
2. Mature apothecia without thalline exciple, 5-O-methylhiascic acid (major) ..... *T. involuta*
2. Mature apothecia with thalline exciple, gyrophoric acid (major) 3
3. Thalline exciple margin cracking into multiple triangular lobes ..... *T. calyciformis*
3. Thalline exciple margin not cracking into multiple triangular lobes .... *T. coarctata*

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Blodgettia sinensis sp. nov. from Lushan Mountain, China

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Abstract—A new asexual fungus *Blodgettia sinensis* is described and illustrated from a specimen collected on dead branches of an unidentified broadleaf tree in Lushan Mountain, China. The fungus differs from other described *Blodgettia* species in its ellipsoidal, brown, 3(–6)-euseptate conidia with rounded apices.

Key words—anamorphic fungi, hyphomycetes, saprobes, taxonomy

Introduction

Blodgettia Harv. was introduced by Harvey (1858) for *B. confervoides* Harv., which was originally collected on rocks near low-water mark in Key West, USA. The name was initially rejected because the type was a mixture of fungal and algal elements, but under the current code (Turland & al. 2018: Art. 9.14) the name is legitimate for the fungal component, emended by Wright (1881) as *B. bornetii* E.P. Wright, nom. illeg. [= *B. confervoides*]. The genus is characterized by short reduced or branched subhyaline conidiophores and solitary acrogenous fusiform moniliform euseptate conidia seceding schizolytically from monoblastic integrated terminal conidiogenous cells (Wright 1881, Seifert & al. 2011). Subsequently, Subramanian (1954) added

B. indica Subram. from India on dead stubble in water. Udaiyan (1992) published an invalid species "*B. aquatica*" Udaiyan from beech test blocks in storage tank and cooling tower in India, without the required typification details. Yang & al. (2017) added *B. saprophytica* C.L. Yang & al. from China on dead stems of an unidentified broadleaf tree.

Saprophytic hyphomycetes are essential components in forest ecosystems and occur with high species diversity on rotten wood, decaying leaves, and dead branches (Ellis 1971, 1976; Subramanian 1971; Castañeda-Ruíz & Kendrick 1991; Zhang & al. 2009; Delgado 2014; Ma & Zhang 2015; Arias & al. 2016; Ma & al. 2016; Xu & al. 2019). During continuing exploration for saprobic microfungi in southern China, an interesting hyphomycete with morphological features of *Blodgettia* was collected on dead branches. It differs from all previously described taxa, and therefore is proposed as new to science.

Blodgettia sinensis Jian Ma & R.F. Castañeda, **sp. nov.** FIG. 1

IF 557002

Differs from other *Blodgettia* spp. by its ellipsoidal, brown, 3(–6)-euseptate conidia with rounded apices.

TYPE: China, Jiangxi Province, Lushan Mountain, on dead branches of an unidentified broadleaf tree, 8 November 2014, J. Ma (**Holotype**, HJAUP M0257).

ETYMOLOGY: refers to the country in which the fungus was collected.

COLONIES on the natural substratum effuse, hyaline to subhyaline. Mycelium partly superficial, partly immersed; hyphae branched, septate, smooth, subhyaline to pale brown. CONIDIOPHORES simple, not distinct from hyphae, subhyaline to pale brown, septate, 2–3.5 µm wide. CONIDIOGENOUS CELLS monoblastic, integrated, terminal, subhyaline to pale brown. Conidial secession schizolytic. CONIDIA solitary, acrogenous, ellipsoidal, 3(–6)-euseptate, distinctly constricted at the middle septum, brown, smooth, the apical cell sometimes triangular, with a rounded apex, the basal cell mostly crucible-shaped, 33.5–41 × 15.5–18.5 µm.

COMMENTS – *Blodgettia sinensis* is distinguished from other species of *Blodgettia* by its ellipsoidal conidia with predominately three eusepta. It further differs from *B. confervoides* [= *B. bornetii*] by occurring on dead branches and not on green algae. The new species also differs from "*B. aquatica*" (conidia 32–52 × 15–25 µm) in its smaller conidia, from *B. saprophytica* (conidia 52.5–64 × 11.5–17 µm) in its shorter and wider conidia that lack a mucilaginous tunica, and from *B. indica*, which is

Fig. 1. *Blodgettia sinensis* (holotype, HJAUP M0257).
Hyphae, conidiophores, and conidia.

distinguished by longer and narrower (20–50 × 7.5–17.5 µm) conidia with strongly attenuated apical cells. In addition, both "*B. aquatica*" and *B. indica* were discovered in water.

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Similitrichoconis wongii gen. & sp. nov. from Ecuador

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Abstract—A new anamorphic genus and species *Similitrichoconis wongii* are described and illustrated. The fungus, found on submerged decaying leaf of an unidentified plant in Ecuador, is characterized by blastic production of obclavate to long fusiform, hyaline phragmoconidia that are rostrate above, uncinate below, and produced by schizolytic conidial secession of clear to translucent conidiogenous cells.

Key words—asexual fungi, hyphomycetes, taxonomy, tropics

Introduction

Trichoconis Clem. (typified by *T. caudata* (Appel & Strunk) Clem.) is characterized by distinct conidiophores, conidiogenous cells that are colorless, single or branched, and have polyblastic sympodial denticulate cylindrical denticles that serve as separating cells in which rhexolytic secession occurs. The solitary conidia are variously shaped (fusiform, obclavate, clavate, ellipsoid, subcylindrical, or navicular), apically and laterally arranged, rostrate, septate,

and colorless (Deighton & Pirozynski 1972). The genus comprises primarily fungicolous, lichenicolous, or saprobic fungi (Clements 1909, Pavgi & al. 1966, Deighton & Pirozynski 1972, Pirozynski 1974, Hawksworth 1980, de Hoog & Oorschot 1985, Matsushima 1989, 1993, Castañeda-Ruiz & Kendrick 1991, Castañeda-Ruiz & al. 1997, Baker & al. 2001, Seifert & al. 2011, Braun & al. 2016, Silva & al. 2016). Index Fungorum (2019) lists 25 species names; however four—*T. crotalariae* M.A. Salam & P.N. Rao, *T. echinophila* (C. Massal.) de Hoog & Oorschot, *T. indica* Pavgi & R.A. Singh, and *T. padwickii* Ganguly—are not recognized for *Trichoconis* because they have definite morphological characteristics (Ellis 1971, Baker & al. 2001, Silva & al. 2016, Braun & al. 2016). During a survey of hyphomycetes associated with plant litter from a tropical rainforest at the Río Palenque Scientific Center near Cantón Buena Fé, Los Rios province (Fig. 1), we collected a fungus somewhat similar to *Trichoconis* but which differs remarkably from all other described genera (Seifert & al. 2011) for which we propose a new genus and species.

Materials & methods

Samples of decaying plant materials were collected and placed in plastic bags for transport to the laboratory, where they were washed, treated according to Castañeda-Ruiz & al. (2016), and placed in moist chambers. Several attempts to obtain this species in pure culture by transferring conidia with a flamed needle to transfer conidia to one part corn meal agar and one part carrot extract and incubating at 25 °C; these attempts were unsuccessful. Mounts were prepared either in polyvinyl alcohol-glycerol (8 g PVA in 100 ml H_2O + 5 ml glycerol) and lactofuchsin (0.1 g acid fuchsin in 100 ml 85% lactic acid) according to Carmichael (1955) or 90% lactic acid. Features were measured at 1000× magnification and photographed using a Zeiss Axioskop 40 microscope with bright field optics. The type specimen is deposited in the herbarium of Microorganism Culture Collections of CIBE (CCM_CIBE), Guayaquil, Ecuador.

Taxonomy

Similitrichoconis R.F. Castañeda, M. Vera & D. Sosa, **gen. nov.**

MB 833730

Differs from *Trichoconis* by its monoblastic terminal determinate conidiogenous cells and schizolytic conidial secession.

Type Species: *Similitrichoconis wongii* R.F. Castañeda & al.

Etymology: *Simili-* (Latin) meaning like, resembling, similar + *-trichoconis* (Latin) referring to the genus *Trichoconis*.

Fig. 1. Mycological survey in the protected rainforest near the Cantón Palenque, Los Rios province, Ecuador.

Fig. 2. *Similitrichoconis wongii* (ex-holotype, CCMCIBE-H641).
Colony from natural substratum.

Colonies on the natural substrate effuse. Conidiophores macronematous, mononematous, unbranched, hyaline. Conidiogenous cells monoblastic, integrated, terminal, determinate, clear to translucent. Conidial secession schizolytic. Conidia solitary, acrogenous, obclavate to long fusiform, euseptate, phragmosporic, hyaline.

Similitrichoconis wongii R.F. Castañeda, M. Vera & D. Sosa, **sp. nov.** Figs 2–5

MB 833731

Differs from *Trichoconis* spp. by its monoblastic determinate conidiogenous cells and the production of obclavate conidia after schizolytic conidial secession.

Type: Ecuador, Los Ríos province, Cantón Buena Fé, Parroquia Patricia Pilar, 0°35′45″S 79°21′49″W, on submerged decaying leaf of an unidentified plant in stream, 18.III.2019, coll. A. Quevedo, M. Vera & F. Espinoza (**Holotype**, CCMCIBE-H641).

Etymology: *wongii* (Latin) The new species is dedicated to Vicente Wong who provided permission and facilities for sample collection in the Rio Palenque reserve belonging to the Wong Foundation

Colonies on the natural substrate effuse, hypophyllous, funiculose, white. Mycelium mostly superficial and immersed; hyphae septate, branched, smooth, 3–5 µm diam, hyaline. Conidiophores macronematous, mononematous, erect or prostrate, flexuous, sinuous, unbranched, 3–5-septate, smooth, hyaline, 45–80 × 6–9 µm, with 2(–3)-cells clear to translucent toward the apex. Conidiogenous cells monoblastic, cylindrical to slightly subulate, strongly curved to uncinate, integrated, determinate, terminal, smooth, clear to translucent, 8–10 × 3–5 µm. Conidial secession schizolytic. Conidia solitary, acrogenous, obclavate, long fusiform, 8–15-euseptate, rostrate toward the apex, rostrum ≤10 µm long, smooth-walled, hyaline, 200–250 × 10.5–14 µm, with a conspicuous, curved to uncinate, clear to translucent basal cell, 2–4 µm long.

Notes: *Similitrichoconis wongii* presents two clear to translucent cells, the conidiogenous cell and (after schizolytic secession) a conidial basal cell. Both clear to translucent cells could be interpreted either as a 2-celled isthmus or two separating cells; unfortunately despite several attempts we obtained no culture that would clarify this uncommon conidiogenous event. The obclavate conidia with a cylindrical hyaline basal cell in *S. wongii* somewhat resemble *Trichoconis* spp. However, the basal frill observed in *Trichoconis* originates after rhexolytic secession of a narrow cylindrical separating cell produced at several loci of the uniformly colored polyblastic conidiogenous cells (Braun & al. 2016, Silva & al. 2016). The cylindrical denticles and pedunculate cells in *Pendulispora venezuelanica* M.B. Ellis (illustrated by Ellis 1961) are

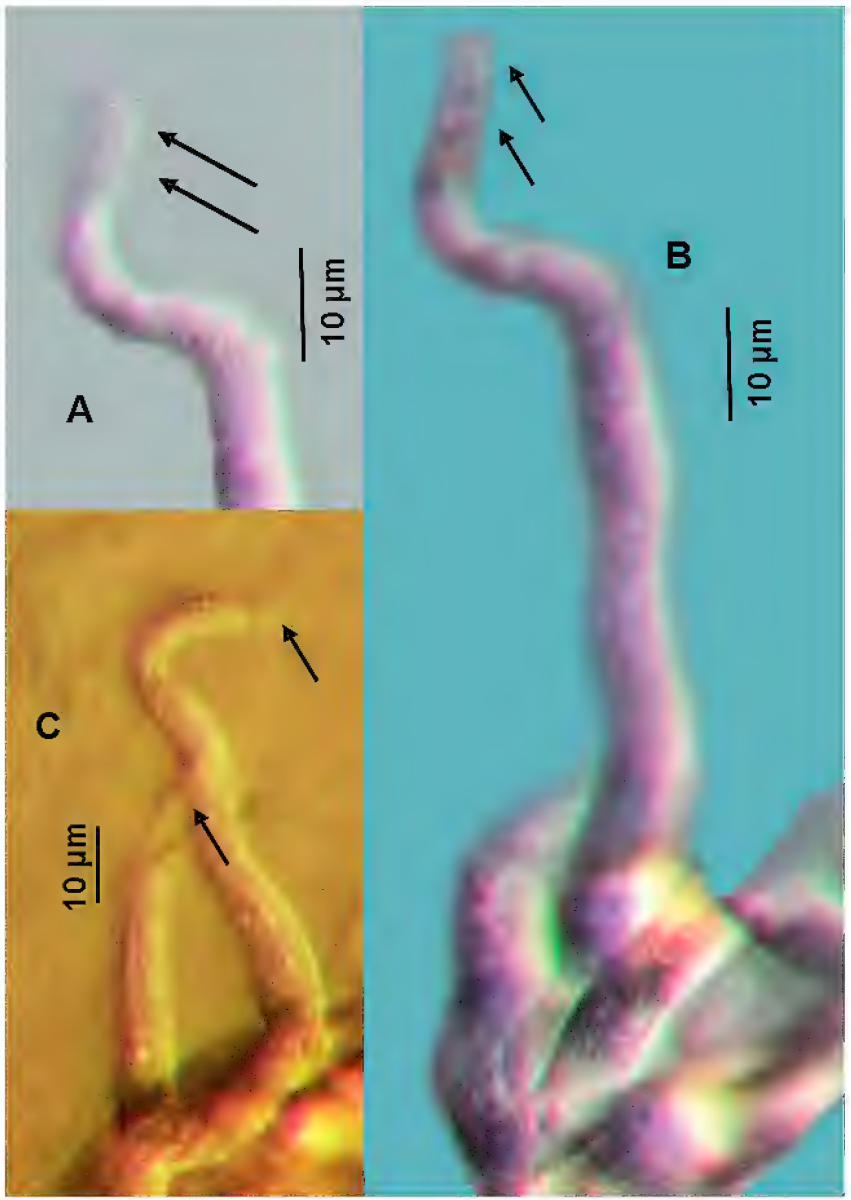

Fig. 3. *Similitrichoconis wongii* (ex-holotype, CCMCIBE-H641). A. Conidiogenous cell; B, C. Conidiophores and conidiogenous cells. (Arrows indicate clear (A,C) and translucent (B) conidiogenous cells.)

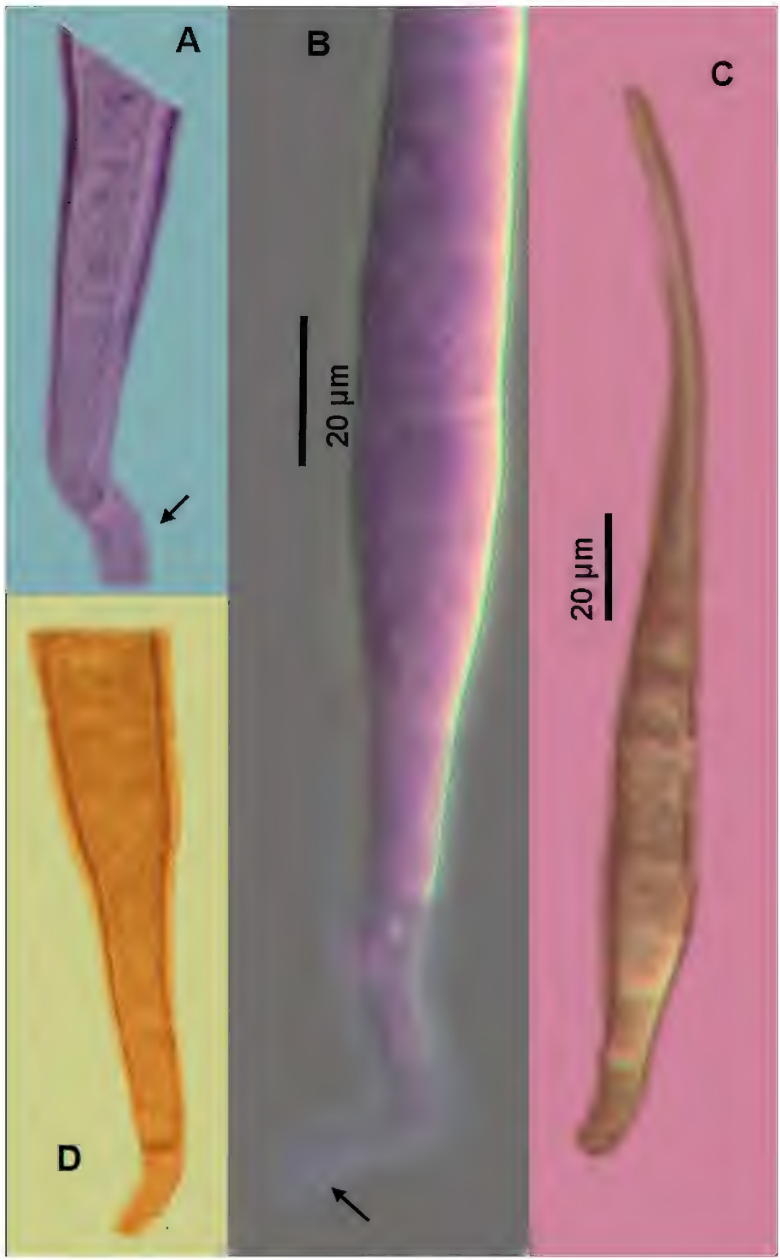

Fig. 4. *Similitrichoconis wongii* (ex-holotype, CCMCIBE-H641). A, D. Lower conidial section above stained translucent basal cells. B. Lower conidial section with curved clear basal cell. C. Conidium with-translucent basal cell.

superficially similar to the conidial basal cells and conidiogenous cells in *S. wongii*, but the evident sympodial extension of the conidiogenous cells are typical of polyblastic conidiogenous cells (Seifert & al. 2011). Ellis (1971), who ignored these sympodial extensions of the conidiogenous cells, described the conidiogenous cells as monoblastic. The existence of hyaline separating cells during and after conidiogenous events occurs in several hyphomycete genera (e.g., *Arcuadendron* Sigler & J.W. Carmich., *Coccidioides* C.W. Stiles, *Chrysosporium* Corda, *Malbranchea* Sacc., *Ovadendron* Sigler & J.W. Carmich.), but there rhexolytic conidial secession occurs during the conidial arthro-thallic disarticulation (Sigler & Carmichael 1976, Seifert & al. 2011).

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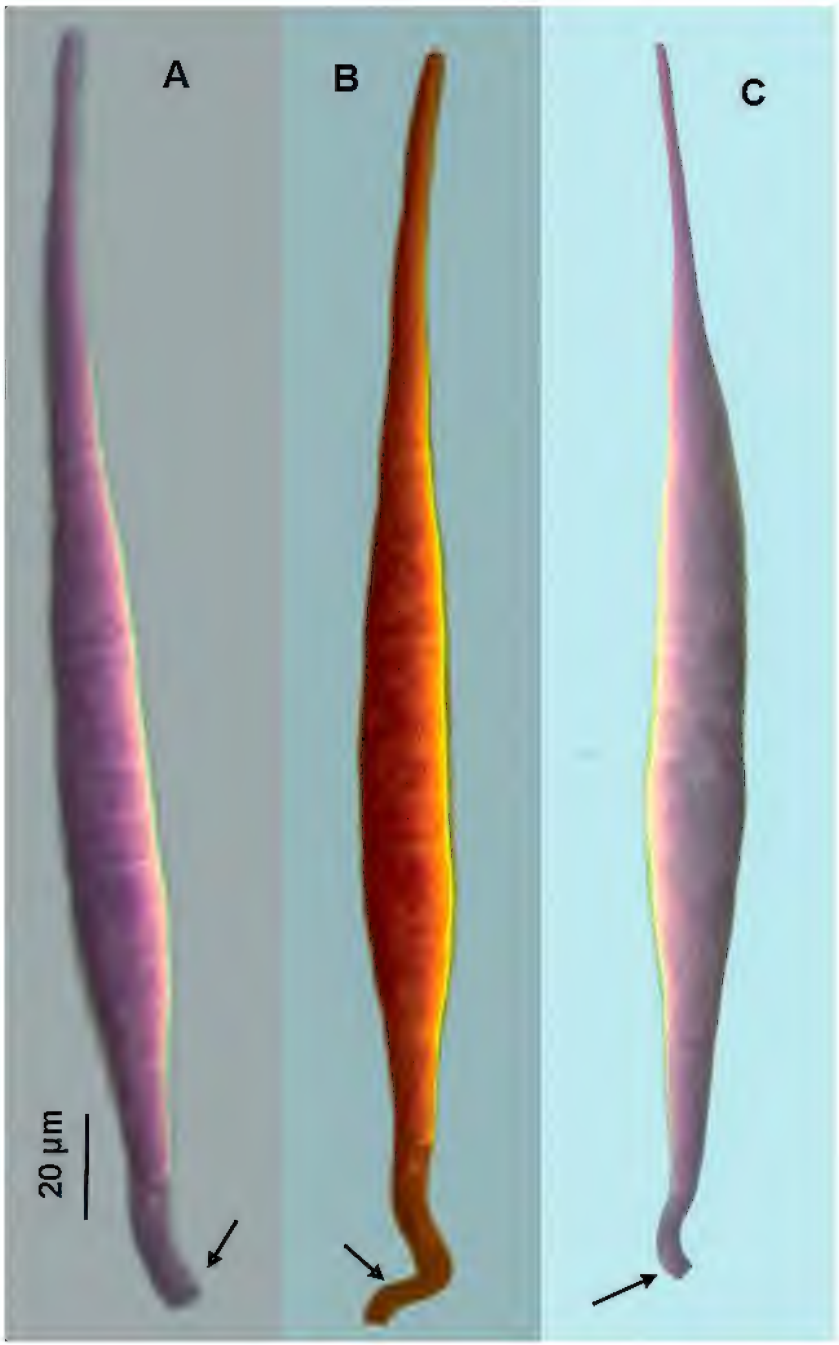
Fig. 5. *Similitrichoconis wongii* (ex-holotype, CCMCIBE-H641). A–C. Conidia with curved translucent basal cells (indicated by arrows) following schizolytic conidial secession.


A
B
C
20 µm

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Three new records of *Porina* from China

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Abstract —Three species of the lichen genus *Porina* are newly reported for China: *P. internigrans*, *P. kamerunensis*, and *P. subrubrosphaera*. Taxonomic descriptions, illustrations, and comments are provided.

Key words —*Ascomycota*, *Lecanoromycetes*, *Ostropales*, *Porinaceae*, taxonomy

Introduction

Porina Ach. (*Porinaceae*) is widely distributed in the tropics and subtropics, and some species also occur in temperate regions. Most species are epiphytic on bark and leaves in shaded and humid environments, while a substantial minority are saxicolous (McCarthy 2000, 2003, 2013; Lücking & al. 2001; Lücking 2008). The genus is characterized by its crustose thallus, perithecioid ascomata, unbranched paraphyses, functionally unitunicate apically thin-walled clavate-cylindrical asci, and transversely septate to muriform hyaline ascospores with thin walls and septa.

Porinaceae includes nearly 400 species (McCarthy 2003, 2013; Lücking 2008; Lücking & al. 2017; Sobreira & al. 2018). The generic concepts in the family are much in flux and a final consensus has not yet been reached. Some authors maintain a more conservative classification, mostly considering *Porina* and *Trichothelium* Müll. Arg. as the main genera (McCarthy 2003, 2013; Lücking 2008). However, most prefer to divide the family into smaller genera, primarily because of the large number of species in *Porina* (Hafellner & Kalb 1995, Harris 1995, McCarthy 1995, McCarthy & Elix 1996, McCarthy & Malcolm 1997, Lücking & al. 2017, Sobreira & al. 2018).

Porina includes more than 300 species worldwide according to McCarthy (2013), and 45 taxa are known from China (Wei 1991, Aptroot & Seaward 1999, Aptroot & Sipman 2001, Aptroot 2003, Aptroot & al. 2003, Liu & Wei 2013, Liu & Zhao 2019). Here, we present new Chinese records of three *Porina* species based on our study of specimens recently collected in southern China.

Materials & methods

The specimens are deposited in the Herbarium Mycologicum Academiae Sinicae – Lichenes, Beijing, China (HMAS-L) and the Fungarium of the College of Life Sciences, Liaocheng University, Liaocheng, China (LCUF). Morphological characters were examined and photographed using Olympus SZX16 dissecting microscopes. Anatomical characters were studied and photographically documented using an Olympus BX53 compound microscope. Thalli were tested using K (a 10% aqueous solution of potassium hydroxide). Lichen substances were analyzed using standardized thin layer chromatography (TLC) (Orange & al. 2010, Jia & Wei 2016).

Taxonomy

Porina internigrans (Nyl.) Müll. Arg.,
Rep. Australas. Assoc. Advancem. Sci. 6: 452 (1895) Fig. 1a–c

Thallus crustose, epiperidermal, continuous to sparingly rimose, somewhat glossy, yellowish green to yellowish brown, incrusted with calcium oxalate crystals. Prothallus dark brown or absent. Photobiont a species of *Trentepohlia*, cells angular-rounded, irregularly arranged, 5–8.5 × 5–6.5 µm. Perithecia numerous, immersed in thallus-dominated verrucae; verrucae 0.5–0.9 mm diam., hemispherical with lightly spreading base, usually solitary, concolorous with the thallus usually for the most part, with broad black spot around ostiole, 0.1–0.3 mm wide, in a shallow depression or flattened at apices, with inconspicuous ostioles. Involucrellum apical to dimidiate, reddish brown, extending to the middle of the exciple, K+ orange-red, 16–50 µm thick. Exciple 15–40 µm thick, yellowish brown, K+ pale orange-red. Centrum 400–420 µm wide. Asci cylindrical, 210–218 × 32–37 µm. Ascospores broadly fusiform, (11–)13(–17)-septate, 89–116 × 12–18 µm; perispore apparent, 2–4 µm thick. Pycnidia not seen.

Chemistry: Thallus UV–, K+ brown. No lichen substances detected with TLC.

Specimens examined: **China. Guizhou Province, Duyun City**, Doupeng Mountain Reserve, Old Post Road, alt. 1154 m, on bark, 17/III/2018, X.H. Wu (LCUF

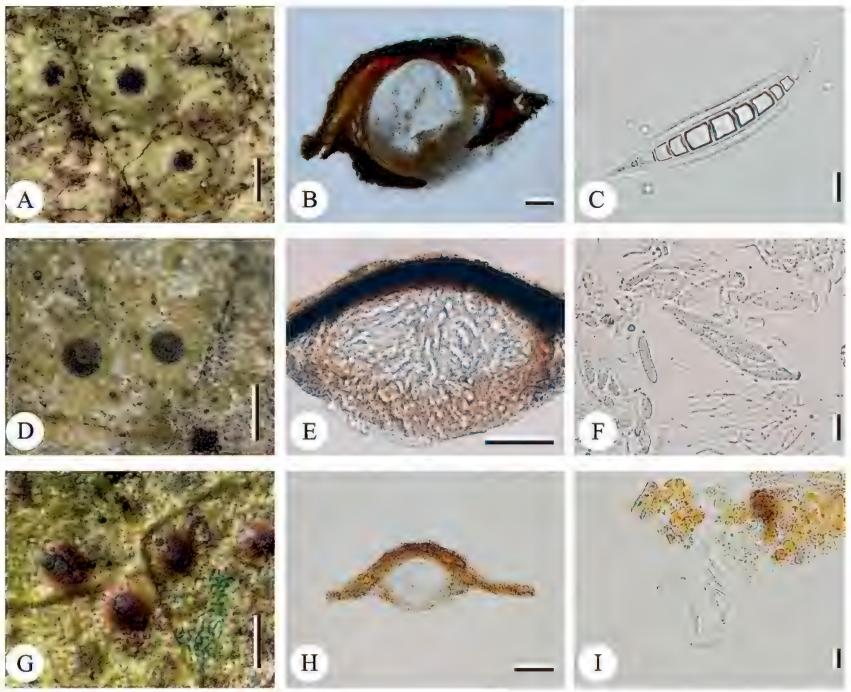

Fig. 1. ***Porina internigrans*** (LCUF, Wu GZ18144). A. Thallus with perithecia; B. Cross section of perithecium in water; C. Ascospore. ***Porina kamerunensis*** (HMAS-L 119188-3). D. Thallus with perithecia; E. Cross section of perithecium in water; F. Ascus and ascospores. ***Porina subrubrosphaera*** (HMAS-L 20190443). G. Thallus with perithecia; H. Cross section of perithecium in water; I. Asci and ascospores. Scale bars: A, D = 0.5 mm; B = 100 um; C, F, I = 10 µm; E, H = 50 um; G = 0.2 mm.

– Wu GZ18144). **Guangdong Province**, **Shixing County**, Chebaling National Nature Reserve, Sanjiaotang, alt. 420 m, on bark, 19/III/2019, S.H. Jiang, C. Zhang (HMAS-L 20190651).

Ecology & distribution: On tree bark. Southwestern and southern China. Palaeotropical (McCarthy 2001) and neotropical (McCarthy 2013).

Remarks: Morphologically, *Porina internigrans* resembles *P. bellendenica* Müll. Arg., which differs in having smaller asci, smaller ascospores, and a thin perispore. The ascospores of our specimens tend to be larger than Australian material of *P. internigrans* (51–92 × 9–17 µm; McCarthy 1994, 2001), but almost identical to the size range of Japanese collections (62–116 × 7–15 µm; Harada 2016).

Porina kamerunensis F. Schill., Hedwigia 67: 289 (1927) FIG. 1D–F

THALLUS crustose, foliicolous, dispersed into radial and roundish patches, smooth and slightly glossy, yellowish green to yellowish brown. PROTHALLUS silvery white or absent. PHOTOBIONT cells rectangular, forming radiating plates, 7–8.5 × 2.6–3.2 µm. PERITHECIA superficial, lens-shaped, base spreading, the centre conical, dark greyish black to black, slightly glossy, 0.25–0.5 mm diam.; apex a black cap; ostiole inconspicuous. INVOLUCRELLUM black to violet-black in thin section, K–, 28–38 µm thick. EXCIPLE 10–20 µm thick, yellowish brown, K–. CENTRUM c. 150 µm. ASCI cylindrical to obclavate, 53–66 × 11.7–14 µm. ASCOSPORES elliptical to bacilliform, 3-septate, 17–23 × 3.7–4.6 µm; perispore not apparent. PYCNIDIA not seen.

CHEMISTRY: Thallus UV–, K+ pale yellow brown. No lichen substances detected with TLC.

SPECIMENS EXAMINED: **CHINA. HAINAN PROVINCE, Ledong City**, Jianfengling, alt. 150 m, on leaf, 21/V/2007, Q.F. Meng M283 (HMAS-L 119188-3); Mt. Bawangling, alt. 820 m, on leaf, 31/VII/2009, Z.F. Jia (HMAS-L 119189).

ECOLOGY & DISTRIBUTION: On leaves. Southern China. Pantropical (Lücking 2008).

REMARKS: Morphologically, this species resembles *P. chrysophora* (Stirt.) R. Sant., which differs in the central part of the perithecia being lens-shaped and the photobiont cells irregularly arranged. It is also similar to *P. oxneri* R. Sant., which differs in its smaller perithecia (0.15–0.25 mm) without a spreading base and its greyish black, matte thallus (Lücking 2004). The ascospores of our specimens tend to be larger than material from Mexico and Costa Rica (14–20 × 2.5–4 µm; Lücking 2008), but almost identical to Australian collections (15–24 × 3–4.5 µm; McCarthy 2001).

Porina subrubrosphaera Kurok., J. Jap. Bot. 33: 206 (1958) FIG. 1G–I

THALLUS crustose, foliicolous, continuous, smooth and slightly glossy, pale greyish green. PROTHALLUS absent. PHOTOBIONT cells angular-rounded, irregularly arranged, 4–9 × 2.5–5.5 µm. PERITHECIA superficial, lens-shaped to wart-shaped or hemispherical with a slightly spreading base, 0.1–0.2 mm diam., dark red-brown; apex a dark red; ostiole inconspicuous. INVOLUCRELLUM apical to dimidiate, red-brown, extending to the base of the exciple, K+ orange-red, 10–25 µm thick. EXCIPLE 5–11 µm thick, yellowish brown, K+ pale orange-red. CENTRUM 77–84 µm wide. ASCI obclavate, 41–58 × 7–9.8 µm. ASCOSPORES oblong, 3-septate, 13–18.6 × 2.5–3.4 µm, 4.6–6.6 times as long as broad; perispore inconspicuous. PYCNIDIA not seen.

Chemistry: Thallus UV–, K+ brown. No lichen substances detected with TLC.

Specimens examined: **CHINA. Fujian Province, Wuyishan City**, Shibazhai Scenic Area, alt. 500 m, on leaf, 16/III/2019, W.C Wang (HMAS-L 20190436; HMAS-L 20190443); Longchuan Grand Canyon, alt. 400 m, on leaf, 16/III/2019, W.C Wang (HMAS-L 20190411; HMAS-L 20190419).

Ecology & distribution: On leaves. Southern China. Japan, Thailand (McCarthy 2013).

Remarks: This species is characterized by its greenish thallus with non-radiating photobiont, dark red-brown perithecia, and its oblong and 3-septate ascospores. It is closely related to *Porina limbulata* (Kremp.) Vain., which has a yellowish thallus with radiating photobiont cells, larger perithecia (0.2–0.4 mm diam.), and larger ascospores (21–27 × 3–5 µm; Lücking 1996, 2008). Another similar species, *P. rubentior* (Stirt.) Müll. Arg., has lens-shaped perithecia that are glossy or slightly translucent, while photobiont cells are rectangular, in radiating plates (Lücking 2008). *Porina subrubrosphaera* is also similar to *P. leptospermoides* Müll. Arg., which has lens-shaped to applanately conical with spreading base and blackish red perithecia (Lücking 1996, 2008). The ascospores of our specimens are similar to the size range of Japanese materials (17–18 × 3 µm), which differ by having a broader centrum (100–150 µm) and larger asci (55–75 µm; Kurokawa 1958; Thor & al. 2000).

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First report of *Hericium cirrhatum* from Pakistan

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Abstract—*Hericium cirrhatum*, a widespread but locally rare tooth fungus is reported for the first time from Pakistan. This species is characterized by white to cream semicircular basidiomata (usually arranged in tiers) with a granular to slightly spiny sterile upper surface, a fertile under surface with 10–15 mm long pointed spines, and ellipsoid to subglobose basidiospores. Morphological characters and DNA sequence analyses inferred from the nuclear ribosomal internal transcribed spacer region (nrITS) confirm the identity of the taxon.

Key words — *Basidiomycota*, *Hericiaceae*, macrofungi, new reports, Swat District

Introduction

Hericium Pers. (*Hericiaceae*) is a saprotrophic genus with worldwide distribution. Macroscopically it is characterized by annual fleshy basidiomata with spiny hymenial surfaces. Important microscopical characters include thick-walled, amyloid, globose to ellipsoid basidiospores, a monomitic hyphal system with clamp-connections, and scattered gloeocystidia (Das & al. 2011). In Pakistan, it is represented by four species: *H. caput-ursi* (Fr.) Banker, *H. clathroides* (Pall.) Pers., *H. coralloides* (Scop.) Pers., and *H. erinaceus* (Bull.) Pers. (Ahmad & al. 1997). During macrofungal surveys in 2015–17 we collected *H. cirrhatum* from two different sites in district Swat, Khyber Pakhtunkhwa, Pakistan. These constitute the first records of *H. cirrhatum* from Pakistan.

District Swat, a floristically blessed land, lies in extreme northern Pakistan in the Malakand division of Khyber Pakhtunkhwa province. It is located at 34°34′–35°55′N 72°08′–72°50′E, covering an estimated area of 5737 km^2. The region is predominantly mountainous with the highest peak of Falak Sar towering almost 6000 m a.s.l. (Barinova & al. 2013). The region is humid, with mild summers, an average annual rainfall >1000 mm, and an 18°C mean annual temperature (Adnan & al. 2006). Annually June (mean maximum temperature = 33°C) is the hottest month and January (mean minimum temperature = –2°C) is the coldest (Barinova & al. 2013). Variations in altitude and exposure greatly modify the climatic conditions within the area. On the basis of altitude, climate, and vegetation, the area can be divided into many climatic and vegetation zones varying from sub-tropical *Pinus roxburghii* Sarg. (chirr pine) forests to alpine pastures and meadows. Forests within the survey area are lush green with humus rich floor supporting large numbers of macrofungi.

Materials and methods

Specimen collection and morphological characterization

Specimens were collected during routine macrofungal forays around Ingaro Dherai village, District Swat, Khyber Pakhtunkhwa, Pakistan and photographed in their natural habitat using Canon Power shot A470 camera; important morphological characters were noted in the field. GPS data were retrieved using a Model 590 Garmin Zumo. The specimens were sun dried, put in zip lock bags and kept in freezer for two weeks to kill any insect larvae. Properly dried collections were deposited in Herbarium, University of Swat, Mingora, Pakistan (SWAT) and in Herbarium, University of the Punjab, Lahore, Pakistan (LAH).

Herbarium specimens were examined microscopically using a BOECO Model BM120 light microscope. After rehydration in distilled water, tissues were mounted in 5% (w/v) KOH solution and stained in 1% Congo red aqueous solution. Melzer's reagent was used to indicate amyloidy of the basidiospores and hyphae. Basidiospore, basidial, and hyphal dimensions were calculated from averages of 20 randomly selected samples from all available basidiomata. Measurements were obtained using Piximètre calibrated software. Values in parentheses represent extremes, Q = length/breadth ratio of individual spores, Qe = average length/breadth ratio of all spores from all basidiomata, and Me = average spore measurements. Microscopical characters were drawn using a camera Lucida.

Molecular characterization

DNA extraction followed Porebski & al. (1997). The universal primer pair ITS1F and ITS 4 (White & al. 1990; Gardes & Bruns 1993) was used to amplify the nrDNA Internal Transcribed Spacer region (ITS) comprising ITS1, 5.8S, and ITS2 following

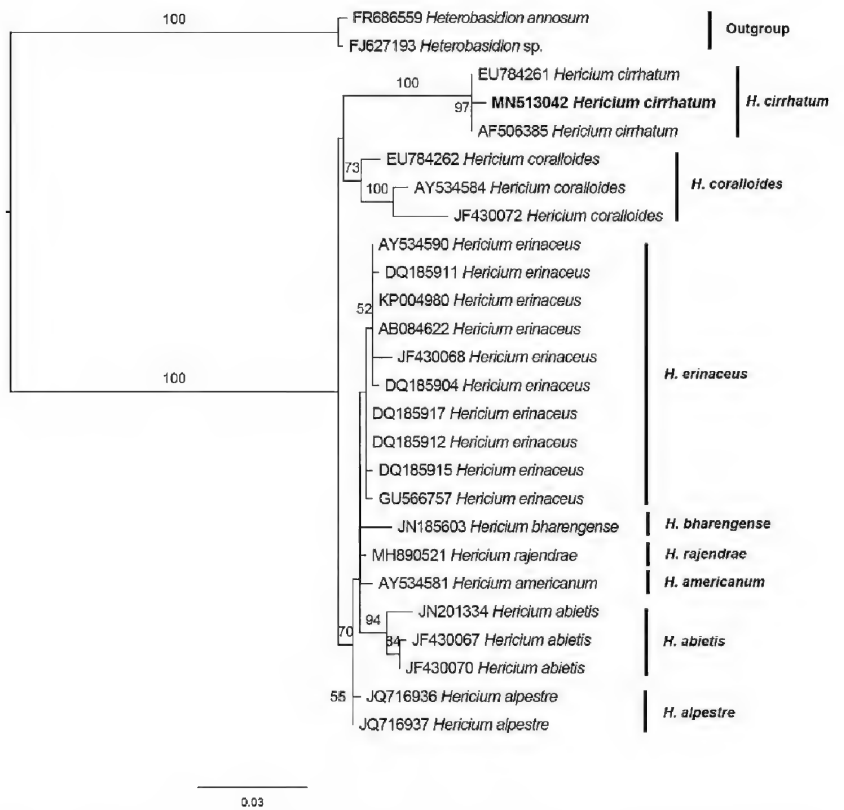

Fig. 1. nrITS based maximum likelihood analysis of *Hericium cirrhatum* and related taxa using RAXML-VI-HPC. Pakistani collection is presented in bold. Bootstrap values ≥50% are given above nodes.

Gardes & Bruns (1993). The PCR amplified product was sequenced by Beijing Genomic Institute (Hong Kong).

The consensus sequence was generated from both forward and reverse primer reads using BioEdit (Hall 1999) and compared with other sequences in the GenBank using the Basic Local Alignment Search Tool (BLAST) on the NCBI website. Closely matching unpublished and published sequences (Das & al. 2011, Hallenberg & al. 2013, Singh & Das 2019) were downloaded for phylogenetic analysis. *Heterobasidion annosum* (FR686559) and *Heterobasidion* sp. (FJ627193) were selected as outgroup taxa following Hallenberg & al. (2013). The downloaded sequences were aligned using Multiple Sequence Alignment Search tool (Muscle) and Clustal X2 (Larkin & al. 2007).

Maximum Likelihood analyses were performed using CIPRES and run in RAXML-VI-HPC (Stamatakis 2006) using the GTRCAT model. Branch support was calculated by 1000 bootstrap replicates.

Phylogenetic analysis

BLAST analysis of the 572 bp ING-26 consensus sequence (Fig 1) showed 99% similarity with *Creolophus cirrhatus* (Pers.) P. Karst. [≡*Hericium cirrhatum*] GenBank EU784261 (from Britain) and AF506385 (from Sweden).

The 26 nucleotide sequences used for phylogenetic analysis represented eight ingroup taxa and two outgroup taxa. After trimming and aligning, the final dataset comprised 548 total sites, of which 142 were variable and 109 parsimony informative. Maximum likelihood analysis nested the Pakistani collection with *Hericium cirrhatum* from Britain and Sweden, confirming its identity as *H. cirrhatum*.

Taxonomy

Hericium cirrhatum (Pers.) Nikol., Acta Inst. Bot. Acad. Sci. USSR Plant. Crypt., Ser. 2, 6: 343. 1950. Figs 2, 3

Basidioma 70–100 mm across, shelf-like, mostly in lateral tiers attached at the base, semicircular to irregular, soft to touch when fresh, hardening upon drying, pure white at first, then turning cream colored, and finally drying brown. Upper surface granulose to echinulate with small sterile spines; margin thin and spinose. Under surface spiny; spines 10–15 mm long, pointed with tapering ends, close, white to creamy at first then turning pinkish and finally brownish on drying. Context concolorous to the exterior, dry to moist, fibrous, 20–30 mm thick at the center and 5–15 mm at the edge. Stipe absent.

Basidiospores (3–)3.1–3.7(–3.9) × (2.2–)2.3–2.9(–3.2) µm, Q = 1.2–1.4, Me = 3.4 × 2.7 µm, Qe = 1.3, broadly ellipsoid to ellipsoid in side view, subglobose to ovoid in face view, smooth, with apiculus, amyloid, hyaline in KOH. Basidia tetrasporic, 30–40 × 4–6 µm, slender, smooth, basal clamp connections present, hyaline in KOH. Contextual hyphae ≤5 µm in diameter, thick-walled, with clamp-connections. Gloeoplerous hyphae 4–9 µm in diameter, frequent, present in both trama and context. Gloeocystidia 75–110 × 6–9 µm, scattered, sinuous.

Material Examined: **PAKISTAN, Khyber Pakhtunkhwa, Swat district**, Ingaro Dherai, village 34°47′19″N 72°19′28″E, 920 m a.s.l., saprobic on decomposing *Populus*

FIG. 2. *Hericium cirrhatum* basidiomata, showing different collections and stages of development. a–c. ING-26 (SWAT001359); d. ING-33 (SWAT001364).

stump, 30 April 2015, Junaid Khan ING-26 (SWAT001359; GenBank MN513042); Ingaro Dherai, 34°47′11″N 72°19′37″E, 925 m a.s.l., in decaying cavities of standing *Populus* tree, 7 August 2015, Junaid Khan ING-33 (SWAT001364).

Discussion

Hericium species are generally rare and grow on wood of broadleaved trees (Boddy & al. 2011). Among the different *Hericium* species, *H. cirrhatum* is rarely documented, and the species has been considered very rare in Britain (Evans & al. 2007, Reilly 2011), Germany, Russia (Volobuev 2013), and most of Europe (Parfitt & al. 2005). In Asia, *H. cirrhatum* has been reported from India (Das & Sharma 2009) and Japan (Crockatt 2008), with no previous reports of this species from Pakistan (Ahmad & al. 1997). Our collections represent a new record for Pakistani mycoflora.

Hericium cirrhatum commonly grows on fallen or cut trunks and branches, and damaged parts of standing trees of *Fagus sylvatica* L., *Quercus* spp., *Acer* spp., *Betula* spp. (Boddy & al. 2011), *Populus tremula*

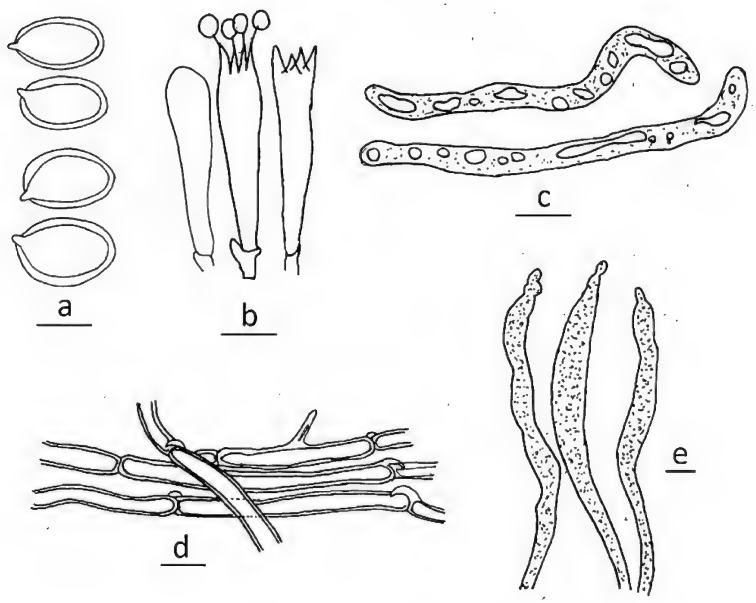

Fig. 3. *Hericium cirrhatum* (SWAT001359). a. Basidiospores; b. Basidia; c. Gloeoplerous hyphae; d. Contextual hyphae; e. Gloeocystidia. Scale bar: a = 2 µm; b–e = 8 µm.

L. (Volobuev 2013), and *Alnus nepalensis* D. Don (Das & Sharma 2009). In our study area, all samples were growing on decomposing stumps or damaged parts of standing *Populus* trees, which is in accordance with the Russian collections.

Morphologically, the present Pakistani collections agree well with the description of *H. cirrhatum* by Das & Sharma (2009). *Hericium cirrhatum* most closely resembles *H. erinaceus*, which is distinguished by longer and more compact spines and more or less circular and fleshier basidiomata. *Hericium caput-ursi,* another closely related species can be distinguished by a branched basidioma with spines hanging in tufts from branch tips.

Distribution data of globally rare taxa are useful, especially from a conservation standpoint. New data calibrate the criteria available for red data listing and help reassess the status of some species (Boddy & al. 2011).

The present report extends the global distribution of *Hericium cirrhatum*, but further studies are recommended to refine the distribution range of this species within Pakistan and in adjoining countries.

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Beltrania nodulosa sp. nov. from Ecuador

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Abstract— *Beltrania nodulosa,* a new species found on a decaying leaf of an unidentified plant in Ecuador, is described and illustrated. The fungus is characterized by cylindrical-nodulose conidiophores and primarily monoblastic integrated mostly intercalary nodose conidiogenous cells. Its solitary and mostly pleurogenous broadly biconic to rhombic conidia are obtuse or rounded at the apex and inconspicuously mammillate at the base below the inconspicuous transverse supra-equatorial hyaline band.

Key words—asexual fungi, hyphomycetes, taxonomy, tropics

Introduction

Beltrania Penz. (typified by *B. rhombica* Penz.) is characterized by conidiophores that are cylindrical, septate, straight or flexuous, apically acute with a radially lobed basal cell, macronematous, mononematous, and pale olive-yellow, pale brown, or brown and which usually arise close to dark brown or black setae. The conidiogenous cells are polyblastic, terminal, integrated, sympodially extended, and denticulate at the ends, usually producing variously shaped (oval, broadly fusiform, obovate) inflated or collapsed, (sub)hyaline separating cells. The solitary pale yellow-olivaceous

A
B
C

to reddish-brown conidia are rhombic or biconic and unicellular (but with an indistinct pale brown, (supra)equatorial transverse band), usually with some sort of basal denticle and an apex that is either obtuse or rostrate (Pirozynski 1963, Seifert & al. 2011). During a survey of hyphomycetes associated with plant litter from the tropical rainforest at the Río Palenque Scientific Center near the Cantón Buena Fé, Los Rios province (Fig. 1), we collected a *Beltrania* specimen that differed remarkably from all previously named species (Zheng & al. 2020) and which we describe here as new.

Materials & methods

Samples of decaying plant materials were collected and placed in plastic bags for transporting to the laboratory, where they were washed, treated according to Castañeda-Ruiz & al. (2016), and placed in moist chambers. Mounts were prepared either in lactic acid (90%) or in polyvinyl alcohol-glycerol (8 g PVA in 100 ml H_2O + 5 ml glycerol) and lactofuchsin (0.1 g acid fuchsin in 100 ml 85% lactic acid) following Carmichael (1955). Features were measured at 1000× magnification and photographed using a Zeiss Axioskop 40 microscope with bright field optics. The type specimen is deposited in the herbarium of the Culture Collection of Microorganisms, CIBE, Guayaquil, Ecuador. (CCMCIBE).

Taxonomy

Beltrania nodulosa R.F. Castañeda, Quevedo & D. Sosa, **sp. nov.** Figs 2– 4

IF 557074

Differs from *Beltrania onirica* by its nodulose and primarily monoblastic intercalary conidiogenous cells and its broadly biconic to rhombic pale yellowish-brown conidia with obtuse or rounded apices.

Type: Ecuador, Los Ríos province, Cantón Buena Fé, Parroquia Patricia Pilar, 0°35 45 S 79°21 49 W, on decaying leaf of an unidentified plant. 18.III.2019, coll. A. Quevedo, M. Vera & F. Espinoza (**Holotype**, CCMCIBE-H549).

Etymology: *nodulosa* (Latin) referring to the inflated, nodulose conidiogenous cells.

Colonies on the natural substrate effuse, hairy pustule-like, hypophyllous, yellowish-brown. Mycelium mostly immersed; hyphae septate, slightly branched, smooth, 1–2 µm diam., pale brown. Setae cylindrical, erect, straight, 5–8(–11)-septate, subacute or rounded at the apex, radially lobed at the base, smooth-walled, dark brown to black, ≤450 µm long, 25–30 µm broad at the base. Conidiophores macronematous, mononematous, erect,

Fig. 1. A–B. Mycological survey in the protected rainforest near the Cantón Palenque, Los Rios province, Ecuador. C. Team in the laboratory (from left): Fernando Espinoza, Miriam Villavicencio, Adela Quevedo, Rafael F. Castañeda-Ruiz, Lizette Serrano, and Marcos Vera.

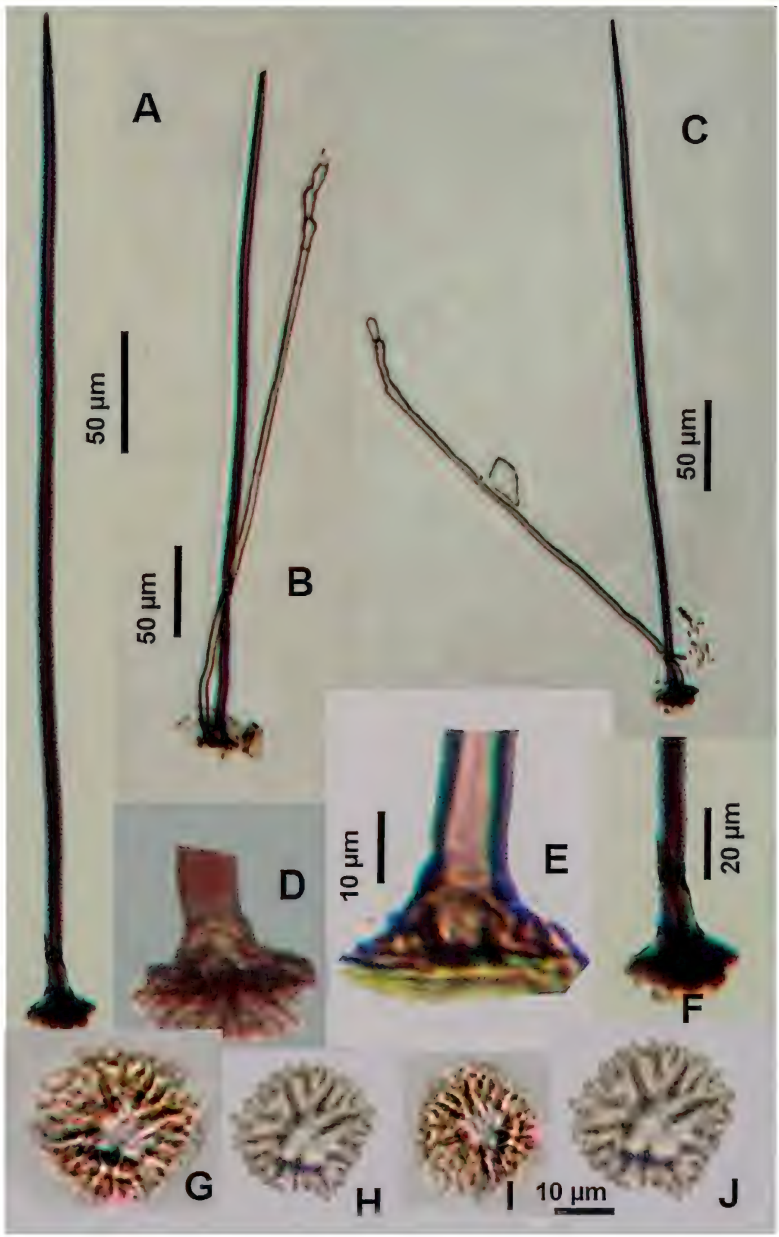

Fig. 2. *Beltrania nodulosa,* (ex holotype, CCMCIBE-H549). A. Seta; B, C. Setae, conidiophores, conidiogenous cells, and a conidium; D–F. Basal sections of the conidiophore and setae; G–J. Radial lobed basal cells of the setae and conidiophores.

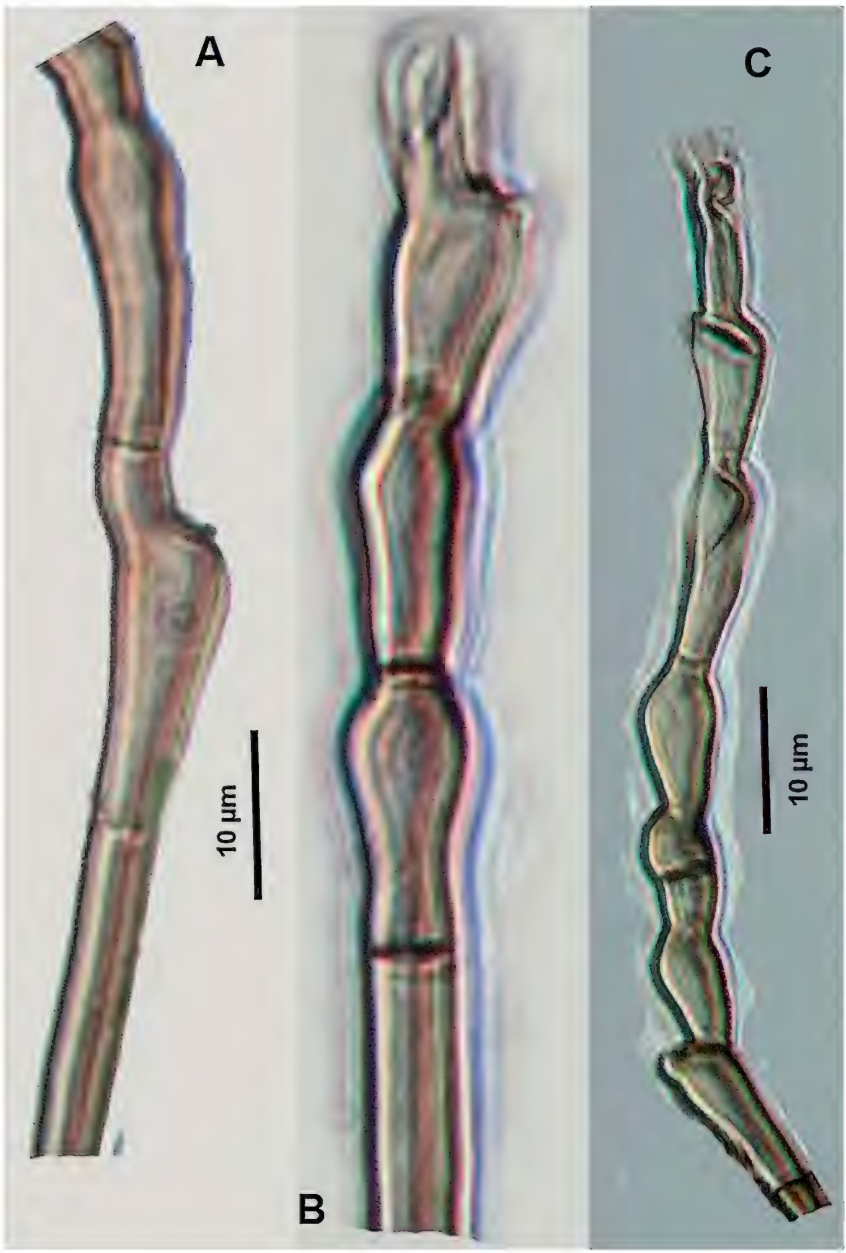

Fig. 3. *Beltrania nodulosa*, (ex holotype, CCMCIBE-H549). A–C. Conidiogenous cells.

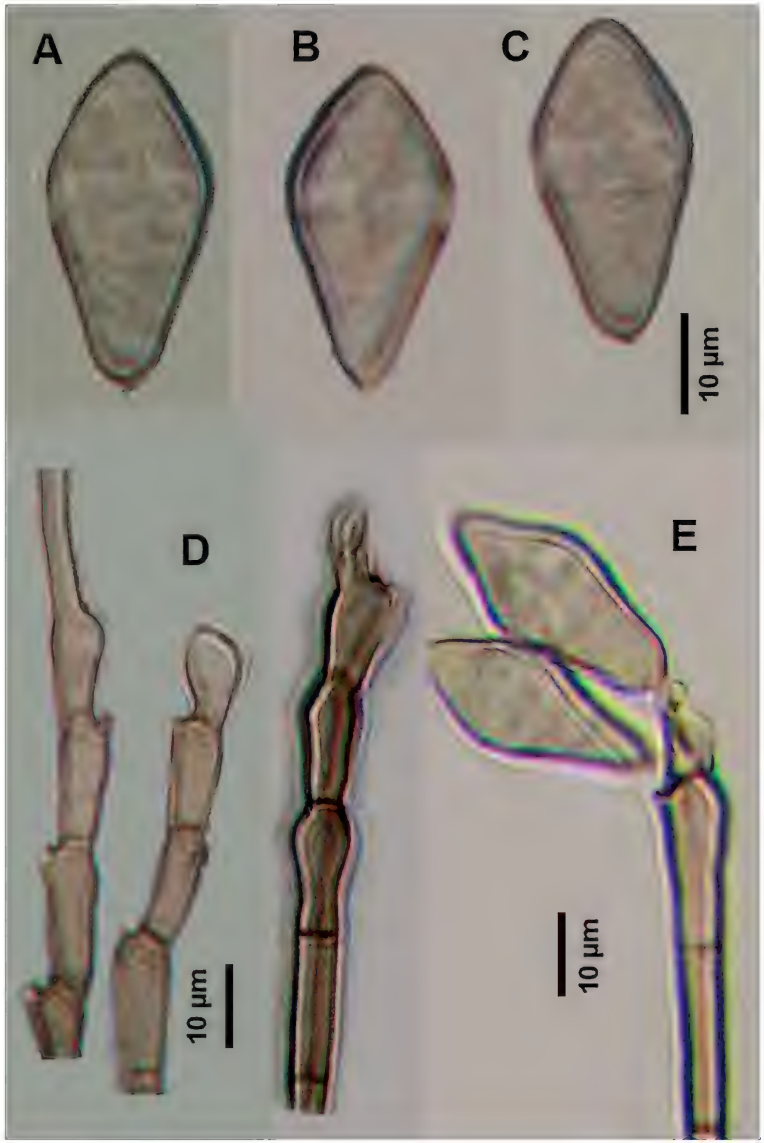

Fig. 4. *Beltrania nodulosa* (ex holotype, CCMCIBE-H549). A–C. Conidia; D. Conidiogenous cells. E. Conidiogenous cells and conidia.

flexuous, cylindrical below, unbranched, irregularly nodulose toward the apex, radially lobed at the base, 6–12-septate, smooth-walled, pale yellowish-brown, 215–350 × 6–13 µm, separate or 1–3 arising from basal cells of setae. Conidiogenous cells primarily monoblastic (sometimes polyblastic), integrated, intercalary and terminal, nodulose, inflated, clavate or subclavate, 12–21 × 6–13 µm with a conspicuous lateral 0.5–1 µm long denticle. Conidial secession schizolytic. Conidia solitary, acropleurogenous (mostly pleurogenous), inequilaterally broadly biconic to broadly rhombic, obtuse to rounded at the apex, inconspicuously mammillate at the base and with a faint transverse supra-equatorial hyaline band, smooth-walled, pale yellowish-brown to pale smoky-brown, 22–30 × 11–20 µm.

Notes: Among accepted *Beltrania* species only *B. eremochloae* Meng Zhang & T.Y. Zhang and *B. onirica* Lunghini, which lack separating cells and a distinct, differentiated apical appendage, are similar to *B. nodulosa* (Onofri & al. 1981, Zhang & Zhang 2003, Zheng & al. 2020). *Beltrania eremochloae* can be distinguished by its consistently polyblastic and terminal conidiogenous cells and its smaller (18–22 × 7–10 µm) biconic-campanulate apically appendiculate olive-buff conidia. *Beltrania onirica* differs in its consistently polyblastic conidiogenous cells and its smaller (19–21 × 11.5–12.5 µm) conic-campanulate apically appendiculate deep olive-buff conidia.

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Bactrodesmium chinense and *B. lushanense* spp. nov. and *B. novageronense* newly recorded from China

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Abstract—Three specimens of *Bactrodesmium* were collected on dead branches of unidentified plants from subtropical forests in Jiangxi, China. Two represent new species: *B. chinense* is distinguished by its ellipsoidal to broadly fusiform 9–11-euseptate verrucose reddish brown conidia with pale brown to subhyaline end cells; *B. lushanense* is characterized by its variably shaped (obovoid, clavate, ellipsoid) verrucose dark brown to black conidia with 3–6 dark-banded eusepta and paler basal cells. The third specimen represents, *B. novageronense*, a new record for China. The three species are described, illustrated, and compared with similar taxa.

Key words—asexual fungi, hyphomycetes, saprobes, taxonomy

Introduction

Bactrodesmium Cooke was established by Cooke (1883) with *Sporidesmium abruptum* Berk. & Broome [≡ *B. abruptum* (Berk. & Broome) E.W. Mason & S. Hughes] later designated by Hughes (1958) as the type species. The genus is characterized by scattered or clustered punctiform dark sporodochial

conidiomata that sometimes become synnematal, inconspicuous fasciculate hyaline to brown conidiophores, and solitary acrogenous variably shaped (clavate, cylindrical, ellipsoidal or obovoid), euseptate conidia formed from monoblastic integrated terminal determinate conidiogenous cells (Ellis 1959, 1971; Seifert & al. 2011). Conidial secession is still not clearly defined for *Bactrodesmium* (Zucconi & Lunghini 1997, Markovskaja 2006, Koukol & Kolářová 2010). Although Zucconi & Lunghini (1997), who critically examined an authentic exsiccatum specimen of *S. abruptum* (Rabenhorst, Fungi Europaei 12: no.1163, 1868), suggested that conidial secession in *Bactrodesmium* should be schizolytic, species with rhexolytic conidial secession continue to be placed in *Bactrodesmium* (Cooper 2005, Koukol & Kolářová 2010, Hernández-Restrepo & al. 2013, Arias & al. 2016). Consequently, the genus has become a heterogeneous assemblage with the addition of unusual species with polyblastic conidiogenous cells (e.g., *B. diversum* Hern.-Restr. & al.), distoseptate conidia (e.g., *B. gabretae* Koukol & Kolářová) and even both euseptate and distoseptate conidia (e.g., *B. rahmii* M.B. Ellis) (Ellis 1976, Koukol & Kolářová 2010, Hernández-Restrepo & al. 2013). Thus, *Bactrodesmium* needs further taxonomic study.

Index Fungorum (2020) lists about 62 species and variety names in *Bactrodesmium*, of which 48 are currently accepted, mostly described from rotten wood, dead bark, and decaying twigs.

Bactrodesmium has been infrequently reported from China, with only six species recorded (Lu & al. 2000, Zhao & al. 2009). During surveys of saprobic microfungi in southern China, three specimens clearly related to *Bactrodesmium* were collected on dead branches. Two of these are proposed here as new species, *B. chinense* and *B. lushanense*, and the third was identified as *B. novageronense*, a new record from China.

Materials & methods

Samples of dead branches were collected and placed in Ziploc™ plastic bags for transport to the laboratory, where they were processed, and examined as described by Ma & al. (2011). The material was photographed using a Nikon Eclipse E200 microscope with a 100× (oil immersion) objective and SmartV550Dc digital camera. The microphotographs were assembled into plates using Adobe Photoshop 7.0.

Taxonomy

Bactrodesmium chinense Z.H. Xu, Jian Ma, R.F. Castañeda & X.G. Zhang, **sp. nov.** Fig. 1

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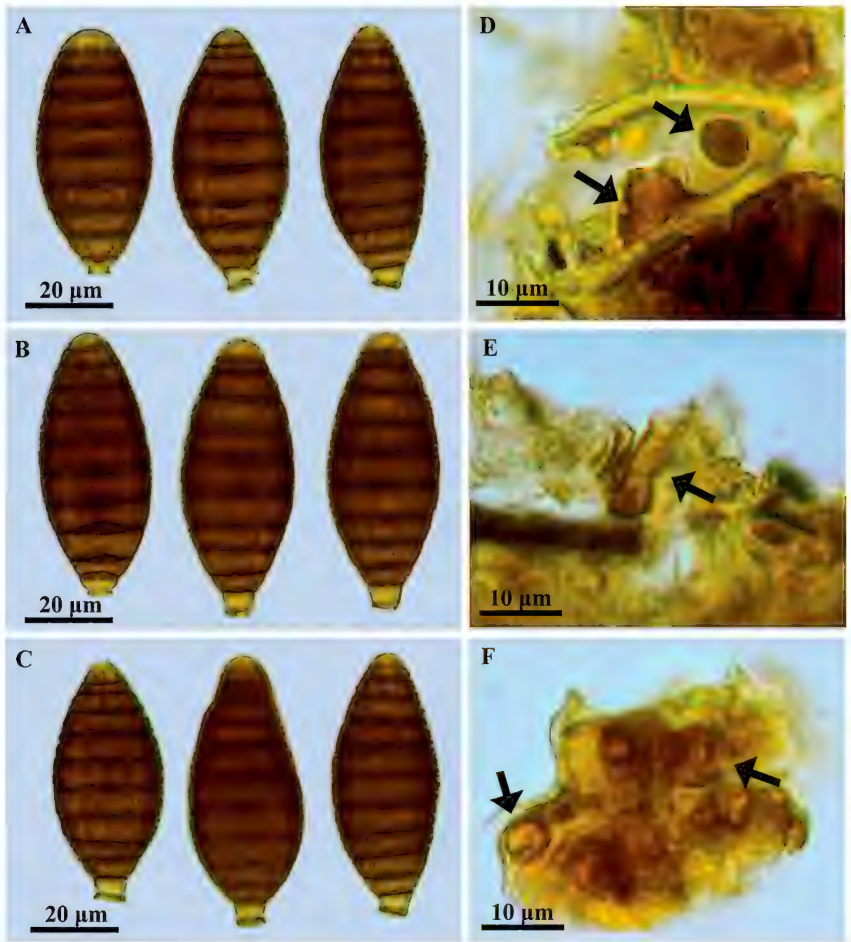

Fig. 1. *Bactrodesmium chinense* (holotype, HJAUP M0282).
A–C. Conidia; D–F. Conidiogenous cells (arrows).

Differs from *Bactrodesmium ellipsoideum* and *B. submoniliforme* by its larger (9–)10(–11)-euseptate reddish brown conidia with pale brown to subhyaline end cells.

Type: China, Jiangxi Province, Jinggangshan Mountain, 26°40′N 114°16′E, on dead branches of an unidentified broadleaf tree, 6 November 2014, J. Ma (**Holotype**, HJAUP M0282).

Etymology: referring to China, where the fungus was collected.

Sporodochia on dead branches scattered or clustered, punctiform, dark brown. Mycelium immersed and superficial; hyphae branched, septate,

smooth, subhyaline to pale brown. Conidiophores micronematous or semi-macronematous, simple, smooth, comprising a single conidiogenous cell. Conidiogenous cells monoblastic, integrated, terminal, determinate, cylindrical, brown to pale brown, 5–13.5 × 5–6.5 µm. Conidial secession rhexolytic. Conidia solitary, dry, acrogenous, ellipsoidal to broadly fusiform, 54–63.5 × 23.5–26.5 µm, (9–)10(–11)-euseptate, verrucose, reddish brown except for the pale brown to subhyaline cell at each end, apex rounded, base truncate, 4.5–6.5 µm diam.

Comments—In terms of conidial morphology, *Bactrodesmium chinense* is most similar to *B. ellipsoideum* P.Rag. Rao and *B. submoniliforme* Hol.-Jech.. However, *B. ellipsoideum* conidia are smaller (30–42 × 9–12 µm) and further distinguished by their ellipsoidal to oval shape, subhyaline to yellowish brown color, and fewer (5–6) eusepta (Rao 1983), while *B. submoniliforme* conidia are also smaller [(25–)30–42.5(–45) × (6–)7–10(–12.5) µm] and differ in their fewer [(5–)8–10] eusepta, pale brown to brown color, pale to hyaline apical cell, and pale brown to subhyaline basal cell (Holubová-Jechová 1972). *Listeromyces insignis* Penz. & Sacc. is superficially similar to *B. chinense* in conidial morphology, but its conidia secede by schizolytic fracture (Goos 1971, Seifert & al. 2011).

Bactrodesmium lushanense Z.H. Xu, Jian Ma, R.F. Castañeda & X.G. Zhang, **sp. nov.** Fig. 2

IF 557034

Differs from *Bactrodesmium palmicola* and *B. microleucurum* in its (3–)5(–6)-euseptate dark brown to black conidia with paler basal cells; differs additionally from *B. microleucurum* in its verrucose conidia.

Type: China, Jiangxi Province, Lushan Mountain, 29°33′N 115°58′E, on dead branches of an unidentified broadleaf tree, 18 October 2016, J. Ma (**Holotype**, HJAUP M0455).

Etymology: refers to Lushan Mountain, where the fungus was collected.

Sporodochia on dead branches scattered or clustered, punctiform, dark brown. Mycelium immersed and superficial; hyphae branched, septate, smooth, subhyaline to pale brown. Conidiophores micronematous or semi-macronematous, simple or branched, smooth, 0–2-septate, pale brown to brown, ≤25 µm long, 2.5–3 µm diam. Conidiogenous cells monoblastic, integrated, terminal, determinate, cylindrical. Conidial secession rhexolytic. Conidia solitary, acrogenous, dry, obovoid, clavate or ellipsoid, (3–)5(–6) euseptate, septa forming dark bands, (14–)25.5–41.5 × (7.5–)14–18.5 µm, dark brown to black, basal cell paler, verrucose, apex rounded, base truncate, 2–2.5 µm diam.

Fig. 2. *Bactrodesmium lushanense* (holotype, HJAUP M0455).
A–E. Conidiophores, conidiogenous cells (arrows) and conidia;
F. Developing conidia; G. Conidia.

Comments—*Bactrodesmium lushanense* most closely resembles *B. palmicola* Mercado & al. and *B. microleucurum* (Speg.) M.B. Ellis in conidial shape. However, *B. palmicola* is distinguished by its 3–4-euseptate, brown conidia with paler basal cells and black apical cells (Mercado-Sierra & al. 1995); and *B. microleucurum* is distinguished by its 2–5-euseptate, smooth, larger (30–48 × 18–25 μm) conidia with wider bases (4–5 μm diam.; Ellis 1965).

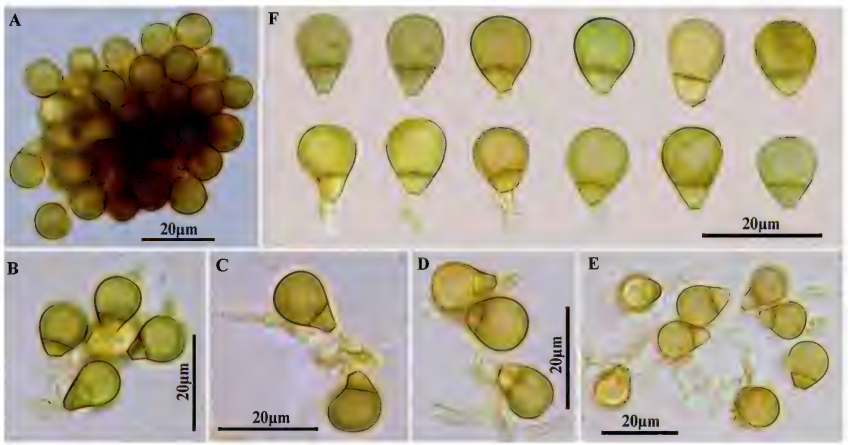

Fig. 3. *Bactrodesmium novageronense* (HJAUP M0225).
A. Sporodochium; B–E. Conidiogenous cells and conidia; F. Conidia.

Bactrodesmium novageronense R.F. Castañeda,
Deuteromyc. Cuba, Hyphomyc. 2: 2, 1985. Fig. 3

Sporodochia on dead branches scattered, pulvinate or punctiform, golden olivaceous brown. Mycelium immersed and superficial; hyphae branched, septate, smooth, subhyaline to very pale brown. Conidiophores micronematous or semi-macronematous, aggregated, simple or branched, smooth, 0–2-septate, subhyaline, ≤15 μm long, 2–3 μm diam. Conidiogenous cells monoblastic, integrated or discrete, terminal, determinate, cylindrical, hyaline. Conidial secession rhexolytic. Conidia solitary, dry, acrogenous, pyriform, obovoid to subglobose, smooth, golden brown to pale brown, 12.5–14.5 × 9–10.5 μm, 1-euseptate, apical cell hemispherical, 7.5–10 × 9.5–10.5 μm, basal cell cuneiform, 3.5–4.5 × 4–5.5 μm, with a distinct 1.5–2.5 μm wide basal frill.

specimens examined: **CHINA, Jiangxi Province, Lushan Mountain**, 29°33 N 115°58 E, on dead branches of unidentified broadleaf tree, 8 November 2014, J. Ma (HJAUP M0221, HJAUP M0225).

Comments—*Bactrodesmium novageronense* is reported for the first time from China. It is most similar to *B. simile* R.M. Arias & al. in producing 1-euseptate conidia, but *B. simile* is easily distinguished by its larger conidia (19–24 × 12–16 μm; Arias & al. 2016). The Chinese collection fits well with the original description of *B. novageronense*, but it has somewhat longer conidia than the Cuban material (8–13 μm; Castañeda-Ruíz 1985).

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Three placodioid species of *Lecanoraceae* new for China

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Abstract — Three placodioid lichen species, *Lecanora valesiaca*, *Protoparmeliopsis sierrae*, and *Rhizoplaca phaedrophthalma*, are reported for the first time from China. Detailed taxonomic descriptions with high resolution photographs, chemistry, remarks, and distribution are provided.

Keywords —ascolichen, pruinose thallus, rosettes, squamulose-areolate, taxonomy

Introduction

Lecanoraceae Körb. (*Lecanorales*, *Lecanoromycetes*, *Ascomycota*) contains 26 genera with about 800 species worldwide (Lücking & al. 2017; Kraichak & al. 2018). Only 153 species representing nine genera have been reported from China thus far: *Carbonea* (Hertel) Hertel (3 spp.), *Clauzadeana* Cl. Roux (1 sp.), *Lecanora* Ach. (119 spp.), *Lecidella* Körb. (13 spp.), *Miriquidica* Hertel & Rambold (3 spp.), *Myriolecis* Clem. (3 spp.), *Rhizoplaca* Zopf (7 spp.), *Protoparmeliopsis* M. Choisy (2 spp.), and *Pyrrhospora* Körb. (2 spp.) (Wei 1991; Abbas & Wu 1998; Abbas & al. 2001; Aptroot & Sparrius 2003; Seaward & Aptroot 2005; Zheng & al. 2007; Zhang & al. 2012; Zhao & al. 2013, 2015; Lü & Zhao 2017). Among them, one *Lecanora* complex (*Lecanora muralis* group) and three genera (*Miriquidica*, *Protoparmeliopsis*, and *Rhizoplaca*) have placodioid or peltate-umbilicate thalli.

During our research on the placodioid taxa of *Lecanoraceae* in China, we identified three new records (*Lecanora valesiaca*, *Protoparmeliopsis sierrae*, *Rhizoplaca phaedrophthalma*), which we describe and illustrate below.

Materials & methods

The specimens were collected from Hebei, Inner Mongolia, Ningxia, Qinghai, Sichuan, and Xizang provinces in China and are deposited in the Lichen Section of the Botanical Herbarium, Shandong Normal University, Jinan, China (SDNU).

The macroscopic characters were examined under a COIC XTL 7045B2 stereomicroscope and photographed using an Olympus SZX16 dissecting microscope. Hand-cut sections were examined microscopically with an Olympus CX41 polarizing microscope and photographed with an Olympus DP72 camera attached to a BX61 microscope. Lichen substances were identified using standardized thin layer chromatography techniques (TLC) with solvent system C (Orange & al. 2010).

Taxonomy

Lecanora valesiaca (Müll. Arg.) Stizenb.,
Ber. Thätigk. St. Gallischen. Naturwiss. Ges.1880-81: 342 (1882) FIG. 1

THALLUS placodioid, surface white to gray, areolate to rimose-areolate, usually forming distinct rosettes, heavily whitish pruinose, esorediate; margin distinct, with lobes, lobes 0.5–1.0 mm wide; prothallus not visible. APOTHECIA lecanorine, sessile, 0.3–1.1 mm in diam, crowded towards thallus center; DISC yellowish brown to brown, epruinose, plane; margin concolorous with thallus, thin to thick, even to prominent, entire to flexuose, smooth, occasionally crenate. AMPHITHECIUM with small crystals insoluble in K; cortex distinct, basally not thickened, 17.5–25 µm thick; algal layer 50–75µm thick; PARATHECIUM hyaline, with crystals insoluble in K; EPIHYMENIUM brown to blackish brown, pigment soluble in K, with fine crystals soluble in K, 7.5–15 µm thick; HYMENIUM & SUBHYMENIUM each hyaline, 25–50 µm thick; HYPOTHECIUM indistinct; PARAPHYSES simple, expanded apically, ≤3.5 µm wide; ASCI clavate, 8-spored; ASCOSPORES hyaline, simple, ellipsoid, 7.5–10(–12.5) × 4–7 µm. PYCNIDIA not observed.

CHEMISTRY: Containing usnic acid.

SPECIMENS EXAMINED: **CHINA. HEBEI, Wenxian**, Mt. Xiaowutai, alt. 2100 m, 23/☒/2012, H.Y. Wang 20121037. **INNER MONGOLIA, Wulatehouqi**, Huhebashenge, alt. 1600 m, 16/VIII/2012, H.Y. Wang 20123653. **NINGXIA, Mt. Helan**, Suyukou, Shibapan, alt. 2400m, 24/VIII/2007, F. Yang 20072669. **QINGHAI, Menyuan**, Xianmilnchang, alt. 2750 m, 18/VIII/2007, Y.D. Du 20072131A-1; **Fengzhakou**, Haibeizhan, alt. 3200 m, 5/VIII/2007, Y.D. Du 20070594-2; **Qilian**, Binggoushangxigou, alt. 3320 m, 10/VIII/2007, X.L. Shi 20071381; alt. 3800 m, 20071432-2. **SICHUAN, Litang**, alt. 4200 m, 5/XI/2008, Z.J. Ren 20080429.

REMARKS: Compared with the published descriptions of *Lecanora valesiaca*, the Chinese specimens present shorter lichen lobes, a smaller apothecial disc, a

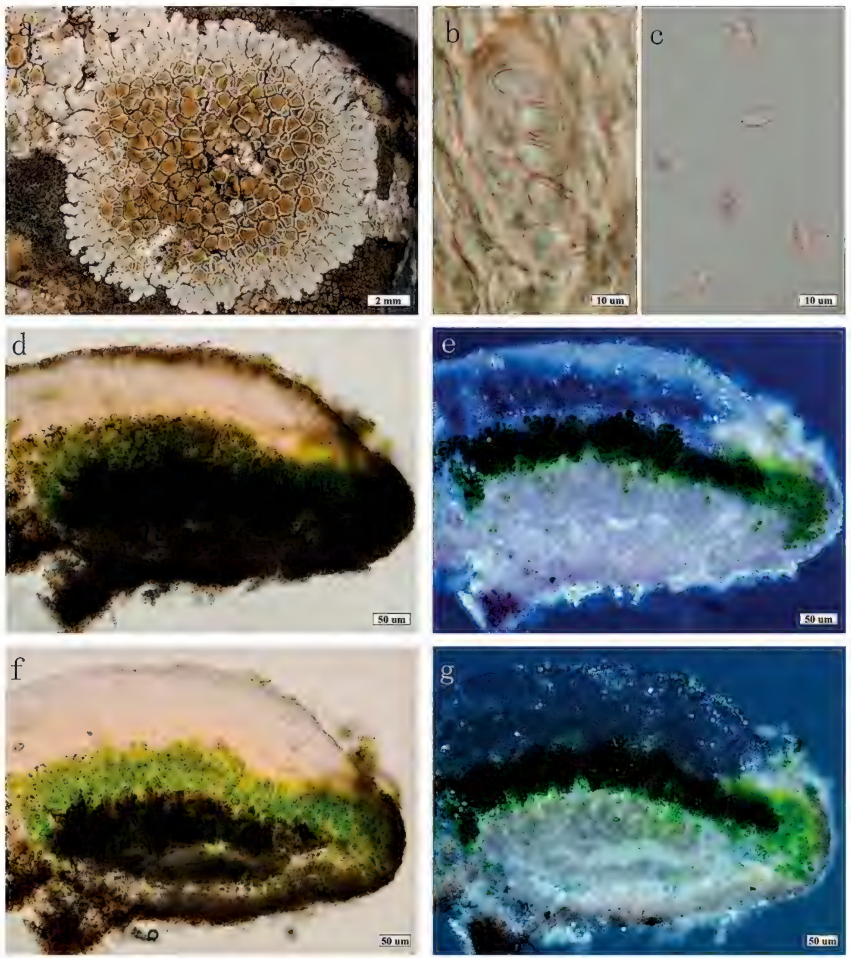

Fig. 1. *Lecanora valesiaca* (SDNU — Ren 20080429). a. Thallus; b. Ascus; c. Ascospores; d. Apothecium (section); e. Crystals in apothecial section; f. Epihymenial pigment, soluble in K; g. Epihymenial crystals, soluble, in K. a = 2 mm; b, c = 10 μm; d–g = 50 μm.

thinner epihymenium, hymenium, and subhymenium, and smaller ascospores. The fact that we did not observe pycnidia may be due to the relatively young age of our collections. *Lecanora valesiaca* is characterized by its closely adnate and completely whitish pruinose thallus and usnic acid as its sole lichen substance. It can be distinguished from other *Lecanora* placodioid species by its thin heavily pruinose thallus and absence of secondary metabolites.

Distribution: *Lecanora* Ach., with 552 species (Kirk & al. 2008), represents the largest genus in *Lecanoraceae*. Worldwide, *L. valesiaca* has been reported from Europe and North America (Ryan 1990). New to China.

Protoparmeliopsis sierrae (B.D. Ryan & T.H. Nash) S.Y. Kondr., Ukr. Bot. J. 69(6): 877 (2012) Fig. 2

Thallus placodioid; surface greenish gray to yellowish green, areolate, forming distinct rosettes, epruinose, esorediate; margin distinct, with lobes,

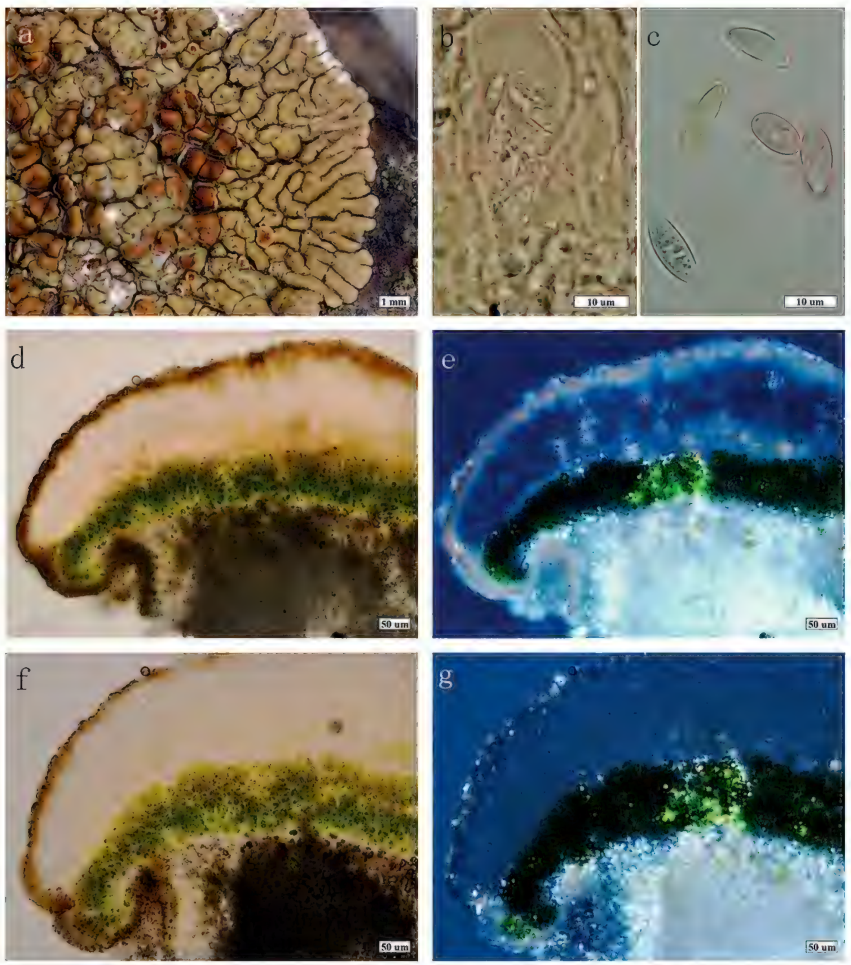

Fig. 2. *Protoparmeliopsis sierrae* (SDNU — Tong 20121126). a. Thallus; b. Ascus; c. Ascospores. d. Apothecium section; e. Crystals in apothecial section; f. Epihymenial pigment, partly soluble in K; g. Epihymenial crystals, soluble, in K. Scale bars: a = 1 mm; b, c = 10 μm; d–g = 50 μm.

lobes 1.5–4.0 mm long, 0.6–1.5 mm wide, rimose-areolate in the center, plane to swollen toward to tips, with surface roughened increasingly toward to tips and occasionally with pruina; PROTHALLUS not visible. APOTHECIA lecanorine, sessile, 0.4–1.3 mm in diam; DISC yellowish brown to reddish brown, epruinose, plane to convex; margin concolorous with thallus, thin, then excluded, even, entire, smooth. AMPHITHECIUM with small crystals soluble in K; cortex distinct, basally not thickened, with small crystals soluble in K, 17.5–30 μm thick; algal layer continuous below the hypothecium, 75–100 μm thick; PARATHECIUM hyaline, with crystals insoluble in K; EPIHYMENIUM reddish brown to dark brown, pigment partly soluble in K, with fine crystals soluble in K, 12.5–20 μm thick; HYMENIUM hyaline, 37.5–50 μm thick; SUBHYMENIUM hyaline, 50–100 μm thick; HYPOTHECIUM hyaline to pale brown, pigment soluble in K, 10–25 μm thick; PARAPHYSES simple, expanded apically, ≤3.5μm wide; ASCI clavate, 8-spored; ASCOSPORES hyaline, simple, ellipsoid, 7.5–15 × 5–7.5 μm. PYCNIDIA immersed, ostioles; CONIDIA filiform, 18–25 μm long.

CHEMISTRY: Containing pannarin and usnic acid.

SPECIMENS EXAMINED: **CHINA. HEBEI, Wenxian**, Mt. Xiaowutai, alt. 2100 m, 28/VIII/2012, D.B. Tong 20121126; alt. 2300 m, 28/VIII/2012, H.Y. Wang 20121538, 20121351. **INNER MONGOLIA, Duolun**, Shisanlitan, alt. 1434 m, 8/VIII/2010, Q. Ren 20101930. **QINGHAI, Mt. Qilian**, Binggouxiaxigou, alt. 3360 m, 10/VIII/2007, Y.D. Du 20071408. **XIZANG, Dangxiong**, Namucuo, alt. 4600 m, 28/VII/2011, Y.L. Cheng 20119125.

REMARKS: The Chinese collections differ from published descriptions of *Protoparmeliopsis sierrae* primarily in the presence of pannarin and usnic acid (and no isousnic acid) as main secondary metabolites. The species is characterized by its brightly coloured placodioid thallus and the presence of pannarin. Its more convex plicate lobes and possession of pannarin instead of zeorin separate *P. sierrae* from *P. muralis*.

DISTRIBUTION: *Protoparmeliopsis sierrae* has been reported from western North America (Ryan & al. 2004). New to China.

Rhizoplaca phaedrophthalma (Poelt) S.D. Leav., Zhao Xin & Lumbsch, Fungal Diversity 78: 302 (2015) FIG. 3

THALLUS placodioid; surface dark yellow to grayish yellow, usually with brownish tint, dispersed, bullate-areolate to squamulose-areolate, areoles occasionally rugose, ≤1 mm wide, esorediate; PROTHALLUS not visible. APOTHECIA lecanorine, sessile, 0.5–1.7 mm in diam; DISC yellowish brown, epruinose, plane to convex; margin concolorous with thallus, thick to excluded

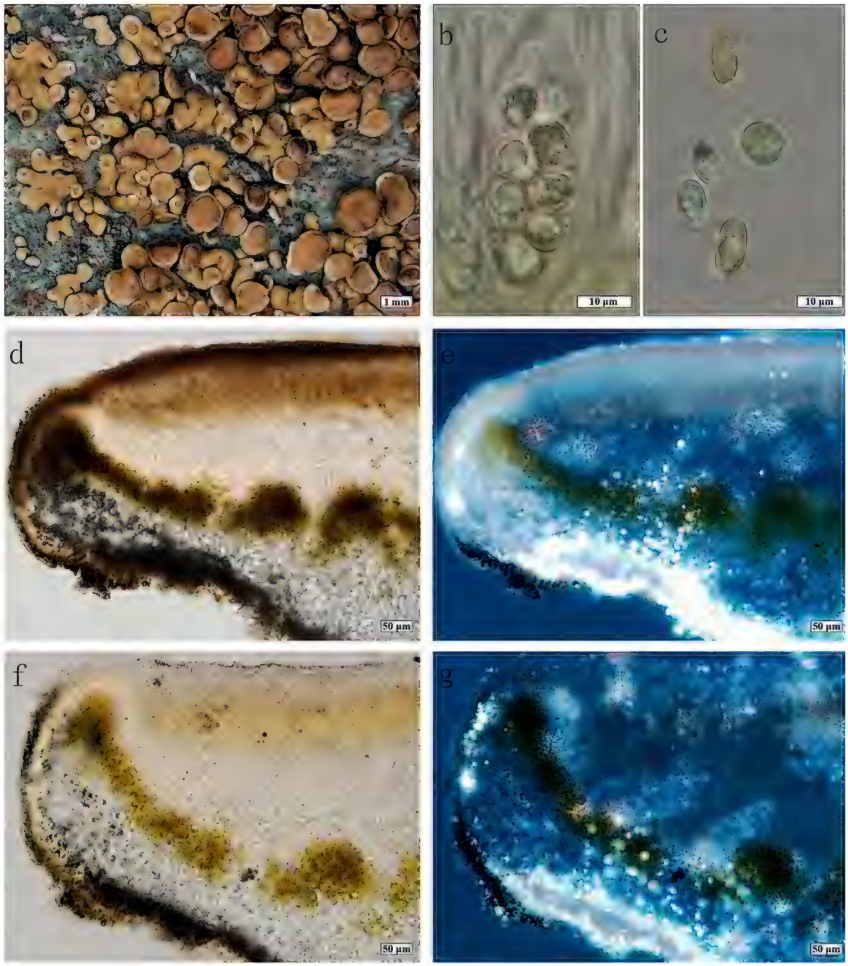

Fig. 3. *Rhizoplaca phaedrophthalma* (SDNU — Du 20070526). a. Thallus; b. Ascus; c. Ascospores; d. Apothecium section; e. Crystals in apothecial section; f. Epihymenial pigment, partly soluble in K; g. Epihymenial crystals, soluble in K. Scale bars: a = 1 mm; b, c = 10 µm; d–g = 50 µm.

(when mature), even, entire, occasionally flexuose, smooth. Amphithecium with small crystals soluble in K; cortex distinct, basally not thickened, 25–30 µm thick; algal layer 50–62.5 µm thick, with medulla between cortex and algal layer, 50–130 µm thick; parathecium hyaline; epihymenium reddish brown to dark brown, pigment soluble in K, with fine crystals soluble in K, 10–15 µm thick; hymenium hyaline, 50–67.5 µm thick; subhymenium

hyaline to pale yellow, 40–65 µm thick; HYPOTHECIUM hyaline, 67.5–83.5 µm thick; PARAPHYSES simple, expanded apically, ≤3.5 µm in diam.; ASCI clavate, 8-spored; ASCOSPORES hyaline, simple, ellipsoid, often not well-developed, 7–10 × 4.5–7 µm. PYCNIDIA not observed.

CHEMISTRY: Containing usnic acid, placodiolic acid, and zeorin.

SPECIMENS EXAMINED: **CHINA. QINGHAI, Menyuan**, Fengzhakou, alt. 3200 m, 5/VIII/2007, Y.D. Du 20070526; 3/VIII/2007, X.L. Shi 20070220; Lenglongling, alt. 3520 m, 7/VIII/2007, Z.S. Sun 20070850-1; 7/VIII/2007, X.L. Shi 20070860; alt. 3630 m, 7/VIII/2007, Y.D. Du 20070961.

REMARKS: The Chinese specimens have a thicker hypothecium than published descriptions and contain zeorin in addition to usnic acid and placodiolic acid. *Rhizoplaca phaedrophthalma* is characterized by a bullate-areolate to squamulose-areolate thallus, occasionally rugose areoles, thick medulla in the amphithecium between cortex and algal layer, and the presence of placodiolic acid. Originally described as *Lecanora phaedrophthalma* Pole, the species was transferred to *Rhizoplaca* based on molecular analysis (Zhao & al. 2016).

DISTRIBUTION: *Rhizoplaca phaedrophthalma* has been reported from central Asia and North America (Ryan & al. 2004). New to China.

Acknowledgments

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Jahnoporus oreinus, a rare fungus found in high-altitude moist temperate forests of Pakistan

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Abstract—*Jahnoporus oreinus* was collected on a buried decomposing roots of spruce during an excursion in the high altitudinal moist temperate forests in the Gabin Jabba valley of district Swat, Khyber Pakhtunkhwa, Pakistan. This species, previously reported from the Russian Far East, represents a new record for the Pakistani mycoflora. This is the first report of the genus *Jahnoporus* in Pakistan.

Key words—*Dacryobolaceae,* ITS, new record, phylogenetic analysis, *Picea*

Introduction

Swat is a floristically rich district in Pakistan's Khyber Pakhtunkhwa province, located at 34°34′–35°55′N 72°08′–72°50′E. Swat borders the Chitral and Ghizar districts in the north, Buner district and Malakand agency in the south, the Shangla and Indus Kohistan districts in the east, and the Dir district in the west. The region is mountainous, with elevations 970–2300 m a.s.l. (Kiran & al. 2017). Climatically, the district comprises dry and moist temperate regions, with lush green forests that are home to many important medicinal and aromatic plants. The forest floors are rich in humus and support a huge diversity of macrofungi. However, compared to plants, fungal research is still in its infancy in Swat, with most of the area under- or unexplored. Therefore the Centre for Plant Sciences and Biodiversity (CPS & B) of the University of Swat initiated a project with the goal of investigating fungal diversity in the under-explored areas of the district.

The present paper, which is part of this project, reports on *Jahnoporus oreinus,* previously unrecorded from Pakistan. This species, first described from eastern Russia by Spirin & al. (2015), is regarded as a strong indicator of pristine *Picea*-dominated forests. With no previous records for the country, *Jahnoporus* (*Dacryobolaceae*) can be regarded as rare in Pakistan. This small genus of wood inhabiting fungi is represented by four species: *J. brachiatus* Spirin & al., *J. hirtus* (Cooke) Nuss, *J. oreinus,* and *J. pekingensis* (J.D. Zhao & L.W. Xu) Y.C. Dai (Index Fungorum http://indexfungorum.org/names/names.asp).

Materials & methods

Collection and morphological examination

The collection was made in the Gabin Jabba valley of District Swat during the summer of 2017. The green valley, politically a part of Swat's Matta tehsil, is characterized by moist temperate vegetation with *Picea smithiana* and *Abies pindrow* the dominant tree species at high altitudes and *Pinus wallichiana* in the foothills (Jabeen & al. 2019). Thick forests of *Quercus semecarpifolia* Sm. are also present in the upper tree limit.

The basidiomata were collected using standard procedures and photographed in their natural habitat. Important macro-morphological characters were noted in a field notebook. Colors were coded following to the Munsell (1975) soil color chart. A fan heater with temperature adjusted at 45–50°C was used for drying the specimens. Properly dried specimens were deposited in the Herbarium, University of Swat, Kanju Township, Pakistan (SWAT).

Microscopic characters are based on free hand sections from dried herbarium specimens mounted in 5% (w/v) aqueous potassium hydroxide (KOH) solution. Aqueous Congo red (1%; w/v) was used for contrast. Tissues were examined and photographed using a BOECO BM120 compound microscope fitted with a MVV 3000 microscopic camera. Microstructures were measured with calibrated Piximètre software v. 5.9; Q = range of length/width (L/W) ratio of all measured basidiospores, Qe = the average L/W ratio of basidiospores, and Me = average L × W of all measured basidiospores.

DNA extraction, PCR, and sequence analysis

DNA from dried herbarium specimens was extracted using the CTAB method (Gardes & Bruns 1993). The internal transcribed spacer (ITS) region along with the central 5.8S region was amplified using the ITS1F (Gardes & Bruns 1993) and ITS4 primer pair (White & al. 1990).

For the polymerase chain reaction (PCR), we followed the methods mentioned in Khan & al. (2017). Two nucleotide sequences were generated from the two different pilei. Both the forward and reverse primer reads were assembled in BioEdit v.7.2.5 (Hall 1999) and consensus sequences were generated. The two consensus sequences

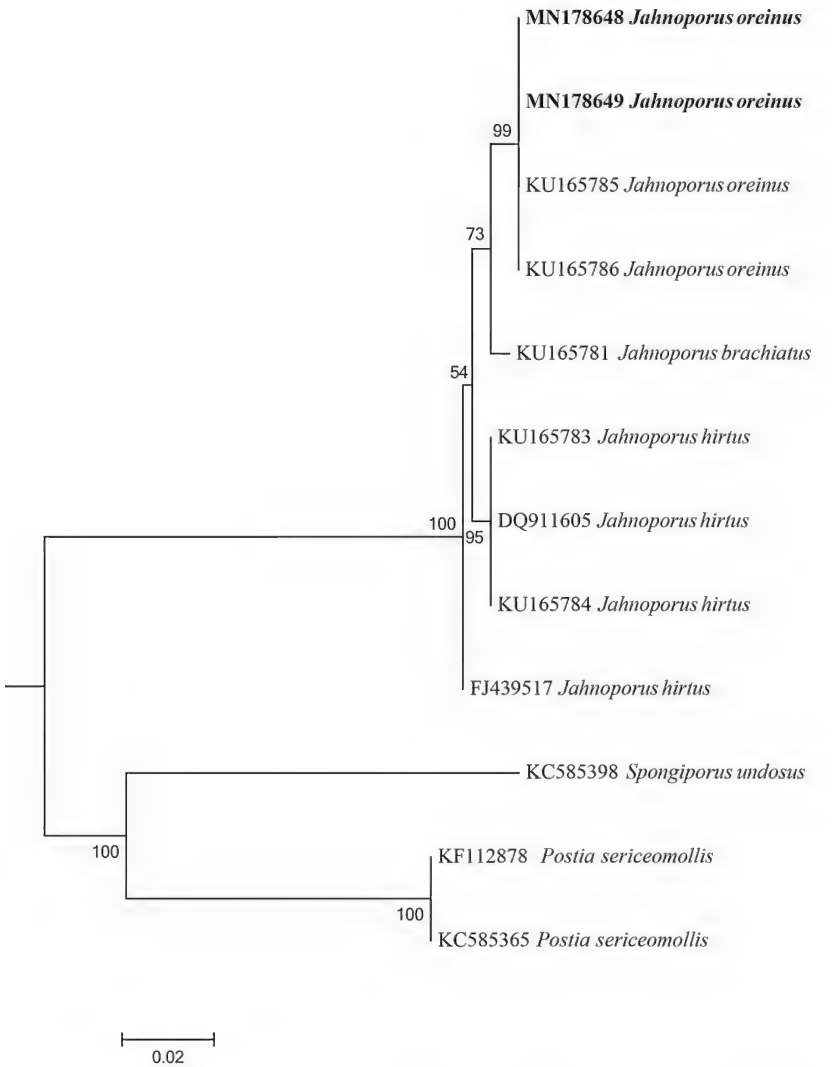

Fig. 1. nrITS based maximum likelihood analysis of *Jahnoporus oreinus* and related taxa. Pakistani collection is presented in bold. Bootstrap values ≥50% are given above nodes.

BLAST searched and closely matching sequences and from published literature (Spirin & al. 2015) were downloaded for phylogenetic analysis. *Postia sericeomollis* (Romell) Jülich (KC585365; KF112878) and *Spongiporus undosus* (Peck) A. David

(KC585398) were selected as outgroup taxa. For phylogenetic inference, Maximum Likelihood (ML) analysis was performed using MEGA6 software with 1000 bootstrap replicates (Tamura & al. 2013).

Phylogenetic analysis

Two new sequences (630 bp each) were generated from two different pilei of the same collection (GJ-1513). During BLAST search, the GJ-1513 sequences showed 99.65 % similarity (different in ≤4 bp) with *Jahnoporus oreinus* (KU165786; KU165785) and 97 % similarity with *J. brachiatus* (KU165781) and *J. hirtus* (KU165782; KU165783; KU165784).

The 12 nucleotide sequences used in the phylogenetic analysis comprised four in-group and two outgroup taxa. There were a total of 571 sites in the aligned dataset, of which 176 were variable and 137 were parsimony informative. Maximum likelihood analysis clustered the ITS sequences in four clades (Fig. 1), which agree with the findings of Spirin & al. (2015). The Pakistani collection clustered with the Russian collections of *J. oreinus,* confirming its identity.

Taxonomy

Jahnoporus oreinus Spirin, Vlasák & Miettinen, Cryptog. Mycol. 36: 414 (2015) Fig. 2

Fruiting body 120 mm wide, annual, fleshy when fresh, hard when mature or dry, several fused pilei arising from a common stipe. Pileus 30–50 mm across, semi-circular to oval in shape, pale greyish-brown (7.5 YR 8/4) with a dark brownish center (5YR 3/4); surface dry, shiny, bumpy, hispid; pileus margin sharp and wavy, slightly incurved in some areas. Pore surface slightly decurrent, cream-colored, drying brownish orange (5YR 5/8); pores mostly angular, some irregular, 2–3 per mm; tubes 2–3 mm deep at the center, 1mm at the edge, concolorous with the pore surface. Stipe 40–50 × 8–12 mm, eccentric, hispid, hairs denser and longer than on pileus, yellowish brown (7.5YR 6/8) upward, strong brown (7.5YR 3/6), interior solid, white. Odor and taste mild.

Basidiospores (13–)13.5–15.9(–16.2) × (4.1–)4.2–5.4(–5.6) µm, Q = (2.7–)3–3.2(–3.3), Me = 15.1 × 4.8 µm, Qe = 3.1, fusoid in face view, navicular in side view, smooth, guttulate. Basidia (35–)40–47(–50) × (9–)10.5–11.5(–12) µm, clavate to narrowly clavate, mostly 2-sterigmate, rarely with 4-sterigmata; thin-walled, hyaline in KOH, with oily droplet, clamped at base; sterigmata 6–8 µm long. Cystidioles (32–)35–43.5(–45) × (5–)5.3–7.5(–8) µm, narrowly lageniform to bottle-shaped, thin- to thick-walled. Pileal Hairs and Upper

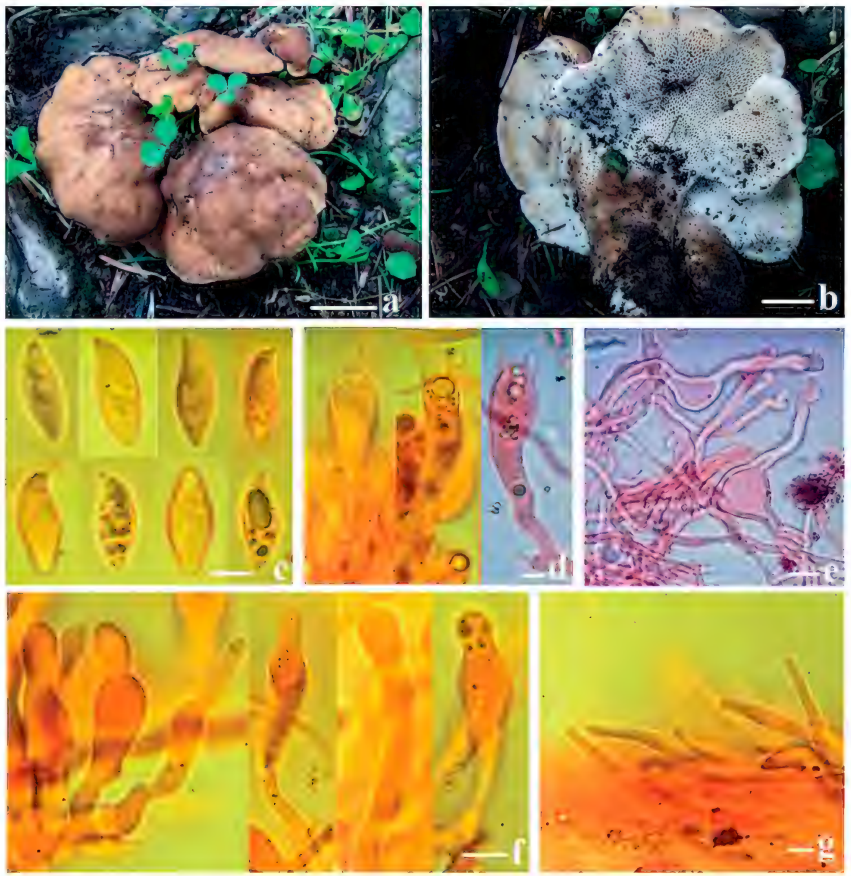

Fig. 2. *Jahnoporus oreinus* (SWAT001350). a. Basidiomata in natural habitat; b. Pore surface; c. Basidiospores; d. Basidia; e. Contextual hyphae; f. Cystidioles; g. Pileipellis hyphae. Scale bars: a, b = 10 mm; c–g = 5 μm.

Surface Hyphae parallel, thin walled, 3–5 μm in diameter. Trama Hyphae elongated, septate, 3–4 μm in diameter. Contextual Hyphae parallel, thick-walled, 3–5 μm in diam., mixed with gloeocystidia; gloeocystidia 70–100 × 10–15 μm, thick walled (≤2μm), irregular. Hyphal System monomitic, clamp connections present.

Material examined: **PAKISTAN**, **Khyber Pakhtunkhwa**, **District Swat**, Matta tehsil, Gabin Jabba valley, 2450 m a.s.l., on buried decomposing roots of *Picea smithiana* (Wall.) Boiss., 30 Aug 2017, Junaid Khan GJ-1513 (SWAT001350; GenBank MN178648, MN178649).

Discussion

Jahnoporus oreinus, a strong indicator species of the old growth spruce forest, is reported as a new record for Pakistani mycoflora. So far, this species is reported from three distant localities in far eastern Russia, with the new collection apparently the fourth record of *J. oreinus* from around the globe. The Pakistani material agrees morphologically with the original description by Spirin & al. (2015) with some differences. Most importantly, the stipe of the Pakistani collection is hirsute and covered by denser and longer hairs compared with the pileus, which differs from the smooth to rarely hairy stipe of the Russian collections. Secondly, the 2-spored basidia in the Pakistani collection are not reported in the original description. Our collection also has very frequent narrowly lageniform to bottle-shaped cystidioles contrasting with the Russian collection where these cystidioles are rare.

Despite the morphological differences between the Pakistani and Russian collections, their ITS sequences were closely similar (differing only by ≤4 bp) and clustered together in molecular phylogenetic analysis (Fig. 1), thus supporting the identification of the Pakistani collection as *J. oreinus.*

Jahnoporus brachaitus, a species reported from East Asia and the Russian Far East, can be distinguished from *J. oreinus* by its growth in lowland mixed forests, pale grey to pale ochraceous pileus, and narrowly fusoid basidiospores (Spirin & al. 2015). *Jahnoporus hirtus*, the type species of the genus, is separated by its larger (≤150 mm diam.), brownish grey to reddish brown pileus, and smaller (10.4–15.4 × 4.0–5.8 µm) basidiospores (Jahn 1973, Spirin & al. 2015). *Jahnoporus pekingensis*, described from northeast China, differs from *J. oreinus* by its larger (≤180 mm diam.) pilei and considerably smaller (9–11.2 × 2.5–3.5 µm) basidiospores (Zhao & al. 1982, Dai 2003).

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Four non-yellow species of *Rhizocarpon* new to China

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Abstract—Four species of the lichen genus *Rhizocarpon* (*R. cinereonigrum*, *R. distinctum*, *R. sublavatum*, and *R. subpostumum*) are reported for the first time from China. Descriptions provide morphological and chemical characters and known distribution of each species.

Key words—lichen-forming fungi, *Rhizocarpaceae*, saxicolous, taxonomy

Introduction

Rhizocarpon Ramond ex DC. (*Rhizocarpaceae*, *Rhizocarpales*, *Lecanoromycetes*, *Ascomycota*) was established by de Candolle in 1805 (Ihlen 2004). *Rhizocarpon* can best be characterized by the crustose thallus, a usually distinct prothallus, black lecideine apothecia, *Rhizocarpon*-type and (1–)8-spored asci, and ellipsoid halonate hyaline to brown or olive-green ascospores that can be transversely septate or submuriform to muriform; *Rhizocarpon* species usually contain secondary compounds detectable by TLC (Fletcher & al. 2009; McCarthy & Elix 2014). *Rhizocarpon* includes about 226 species worldwide (Lücking & al. 2016, Davydov & Yakovchenko 2017), of which 44 species have been reported from China (Wei 1991; Abbas & Wu 1998; Aptroot & Sparrius 2003; Li & al. 2013; Zhao & al. 2013; Mahire & al. 2015; Wang 2015a,b,c, 2016). The genus is most diverse and abundant

[#] Ling Hu & Xiao Zhang contributed equally to this research.

on siliceous rocks, with some species on calcareous rocks and a minority parasitic on other lichens in montane habitats and at temperate to higher latitudes (Ihlen 2004, McCarthy & Elix 2014).

This paper contributes further to our understanding of *Rhizocarpon* in China in the context of the Lichen Flora of China project. We have identified four species new to the country: *R. cinereonigrum*, *R. distinctum*, *R. sublavatum* and *R. subpostumum*.

Materials & methods

The specimens documented here are deposited in the Lichen Section of Botanical Herbarium, Shandong Normal University, Jinan, China (SDNU). Morphological and anatomical characters were examined under a COIC XTL7045B2 stereomicroscope and Olympus CX41 polarizing microscope. The thallus and medulla were tested with K (a 10% aqueous solution of potassium hydroxide), C (a solution of aqueous sodium hypochlorite), and I (Lugol's iodine) for identification. Lichen substances were identified using standardized thin-layer chromatography techniques (TLC) with solvent system C (Orange & al. 2010). The lichens were photographed with an Olympus SZX16 and a BX61 microscope with a DP72 lens.

Taxonomy

Rhizocarpon cinereonigrum Vain.,
Acta Soc. Fauna Flora Fenn. 53(1): 279 (1922) Fig. 1

Thallus crustose, with plane, contiguous areolae, dark greyish to dark brown, esorediate. Prothallus absent. Medulla white, I–. Apothecia black, round to rounded-angular, 0.3–0.5 mm diam., immersed to sessile, lecideine with a well-developed exciple, persistent, concave to flat. Proper exciple dark brown, with crystals partly dissolving in K; epihymenium dark brown, K+ violet-red; hymenium hyaline; paraphyses branched and anastomosing; hypothecium dark brown, K–. Asci 8-spored. Ascospores soon brownish green, 1-septate, with a halo, constricted at the septum when overmature, 28–38 × 12–18 μm. Conidiomata not seen.

Chemistry—Medulla K+ yellow, C–. Stictic acid detected by TLC.

Specimens examined: **CHINA. Sichuan, Kangding Co.**, Mt Zheduo, alt. 4200 m, on siliceous rock, 15 Oct. 2015, Weicheng Wang 20150702 (SDNU); **Luding Co.**, Moxi Town, Yajiagen, alt. 4000 m, on siliceous rock, 13 Oct. 2015, Weicheng Wang 20150665 (SDNU). **Yunnan, Shangri-La**, Mt Hong, alt. 4462 m, on siliceous rock, 18 Aug. 2018, Chunxiao Wang 20180633 (SDNU).

Distribution—Finland, Novaya Zemlya, and Greenland (Lynge 1932; Thomson 1997). New to China.

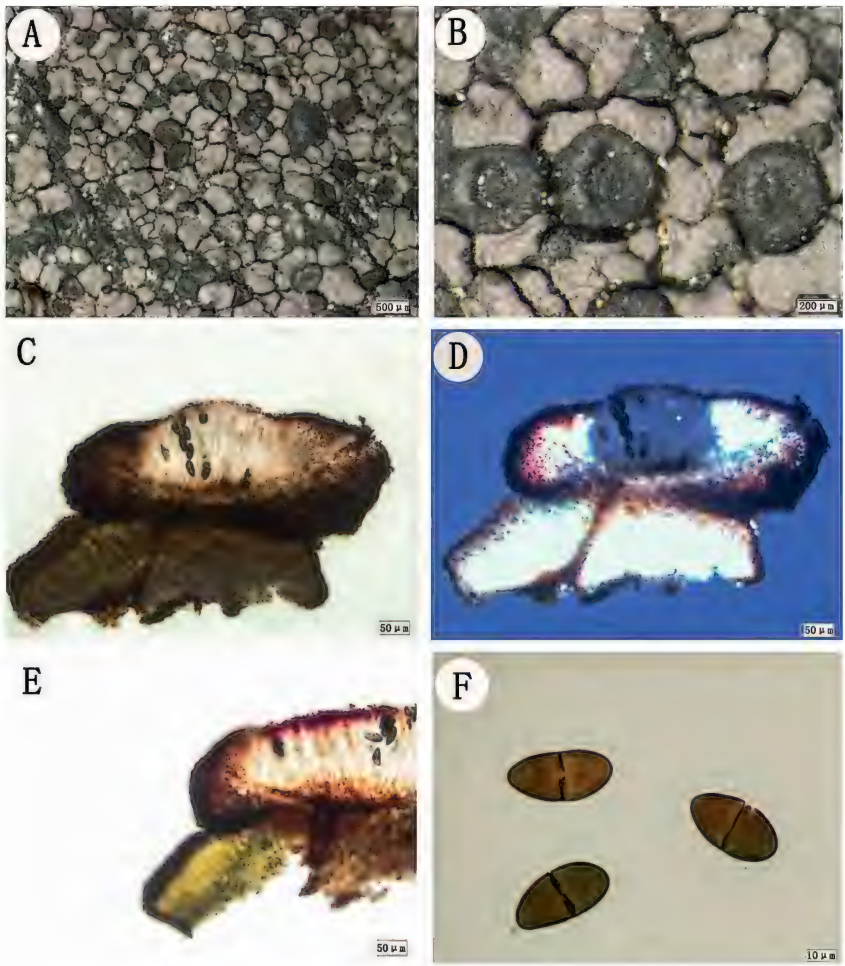

Fig. 1. *Rhizocarpon cinereonigrum* (SDNU – Wang 20150665). A: Thallus; B: Apothecia; C: Apothecium section; D: Crystals in exciple; E: K reaction; F: Ascospores.

Comments—Our specimens are similar to those described previously in the literature, except that the protologue description mentions a prothallus and convex apothecia (Thomson 1967, 1997). *Rhizocarpon cinereonigrum* is characterized by the dark greyish to dark brown thallus, epihymenium K+ violet-red, large 1-septate ascospores, and containing stictic acid. This species morphologically resembles *R. badioatrum* (Flörke ex Spreng.) Th. Fr. and

R. jemtlandicum Malme; however, *R. badioatrum* differs by containing ±stictic, ±norstictic; and diffractic acids, while *R. jemtlandicum* differs in its K–, olive to green-black epithecium (Timdal & Holtan-Hartwig 1988, Fletcher & al. 2009, Wirth & al. 2013).

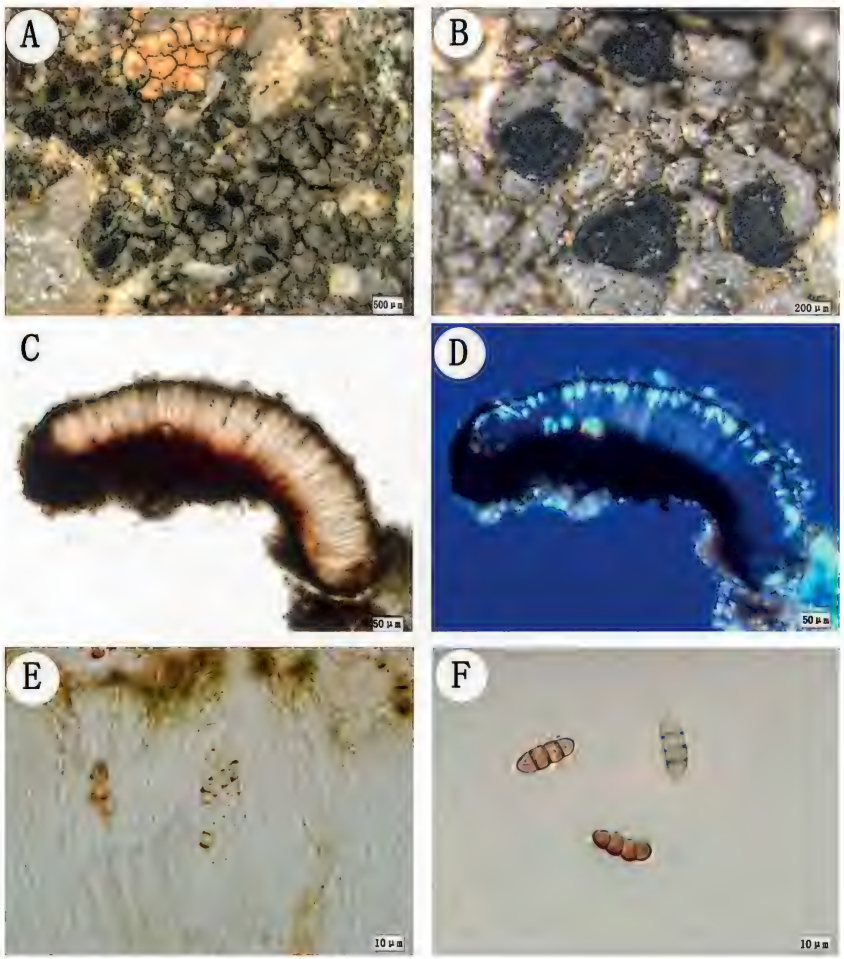

Fig. 2. *Rhizocarpon distinctum* (SDNU – Wang 20151607). A: Thallus; B: Apothecia; C: Apothecium section; D: Crystals in epihymenium; E: Ascus; F: Ascospores.

Rhizocarpon distinctum Th. Fr., Lichenogr. Scand. 2: 625 (1874) Fig. 2

Thallus areolate; areoles small, dark grey, contiguous or more rarely scattered, rounded to angular, convex. Prothallus black. Medulla white,

I+ blue. Apothecia lecideine, black, 0.3–0.5 mm diam., sessile, concave to flat; exciple thin, dark brown, persistent; epihymenium brown to olive-brown, K–, with crystals partly dissolving in K; hymenium hyaline; hypothecium dark brown. Asci 8-spored. Ascospores soon brown, 3-septate to submuriform with 4–6 cells, with a halo, 20–27.5 × 7.5–12.5 µm. Conidiomata not seen.

Chemistry—Medulla K+ yellow, C–. Stictic acid detected by TLC.

Specimen examined: **CHINA. Sichuan, Mt. Zheduo**, alt. 4000 m, on siliceous rocks, 15 Oct. 2015, Weicheng Wang 20151607 (SDNU).

Distribution—*Rhizocarpon distinctum* has been reported from Europe, British Isles, North America (eastern Canada), Antarctica, Novaya Zemlya, Australia, and New Zealand (Lynge 1932, Thomson 1997, Øvstedal & Smith 2001, Ihlen 2004, Fletcher & al. 2009, Galloway 2007, McCarthy & Elix 2014). New to China.

Comments—Our specimens match previously published descriptions, except for the presence of an epihymenium containing crystals partly dissolving in K (Ihlen 2004, Fletcher & al. 2009). *Rhizocarpon distinctum* is characterized by the amyloid medulla, 3-septate to submuriform ascospores, and the occurrence of stictic acid (Timdal & Holtan-Hartwig 1988, Thomson 1997, Øvstedal & Smith 2001, Ihlen 2004, Fletcher & al. 2009, McCarthy & Elix 2014). The small areoles and apothecia of *R. distinctum* are suggestive of *R. reductum* Th. Fr., *R. sublavatum* and *R. timdalii* Ihlen & Fryday, but *R. distinctum* can be distinguished from those species in becoming brown and in usually having fewer than eight cells per ascospore (Ihlen 2004, Fletcher & al. 2009).

Rhizocarpon sublavatum Fryday, Lichenologist 32(3): 214 (2000) Fig. 3

Thallus areolate, greyish brown, continuous, flat. Prothallus black. Medulla white, I–. Apothecia lecideine, black, round, 0.3–0.6 mm diam., sessile, concave; disc epruinose; exciple black, thick, usually persistent. Proper exciple dark brown, without crystals; epihymenium bluish green, K+ brighter; hymenium hyaline; hypothecium dark brown. Asci 8-spored. Ascospores colourless, eumuriform, 25–35(–37.5) × (10–) 12.5–15(–17.5) µm. Conidiomata not seen.

Chemistry—Thallus K–, C–. Medulla K–, C–. No substances detected by TLC.

Specimen examined: **CHINA. Sichuan, Luding Co.**, Moxi Town, Park. Hongshi, alt. 3060 m, on siliceous rock, 13 Oct. 2015, Weicheng Wang 20150660 (SDNU)

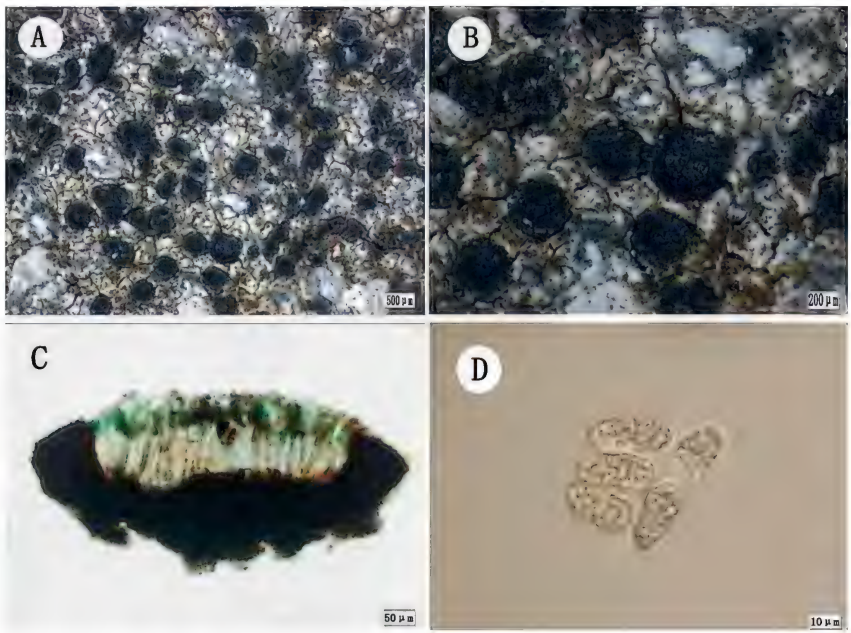

Fig. 3. *Rhizocarpon sublavatum* (SDNU – Wang 20150660). A: Thallus; B: Apothecia; C: Apothecium section; D: Ascospores.

Distribution—Great Britain (Scotland), Scandinavia, Iceland, and Central and Eastern Europe (Fryday 2000; Ihlen 2004). New to China.

Comments—Our specimen agrees with the type description, except that the protologue cites an effuse thallus and a flat to slightly convex disc (Fryday 2000). *Rhizocarpon sublavatum* is characterized by having smaller eumuriform spores than *R. lavatum* (Ach.) Hazsl., a bluish green epihymenium, and no lichen substances. The species shares a similar ascospore size and shape with *R. anaperum* (Vain.) Vain., which differs in a browner, more granular-areolate thallus, more highly branched paraphysoids, and a different apothecial pigmentation with only brown and grey pigments (Fryday 2000).

Rhizocarpon subpostumum (Nyl.) Arnold,
Verh. Zool.-Bot. Ges. Wien 27: 554 (1877) Fig. 4

Thallus areolate; areoles flat to slightly convex, polygonal to rounded, brown, epruinose. Prothallus indistinct. Medulla white, I–. Apothecia

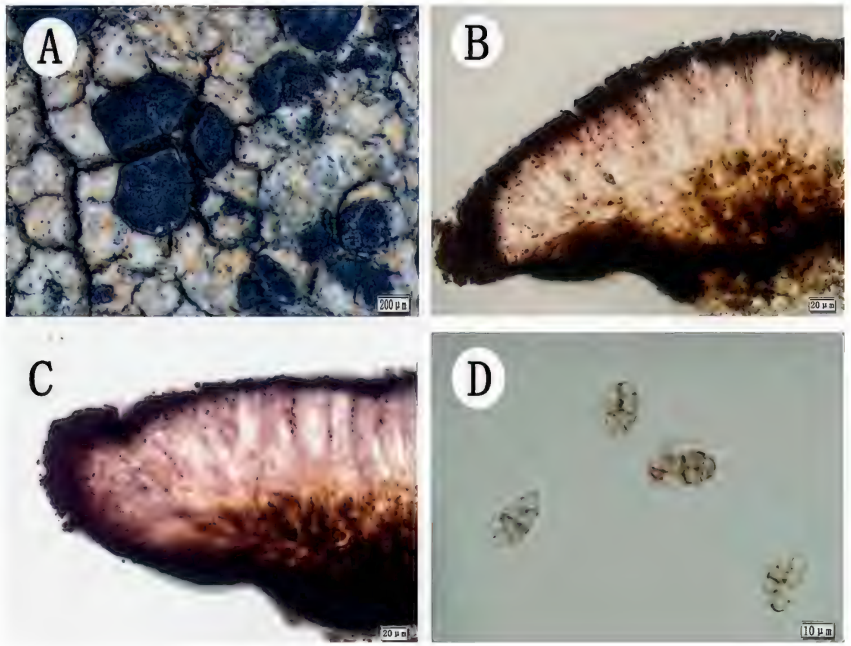

Fig. 4. *Rhizocarpon subpostumum* (SDNU – Du 20080268). A: Thallus and apothecia; B: Apothecium section; C: K reaction; D: Ascospores.

black, rounded to angular, 0.3–0.6(–0.8) mm diam., usually immersed, lecideine with a thin margin, flat to convex. Proper exciple dark brown, K+ purple; epihymenium dark green-black, K–; hymenium vertically streaked red-brown and K+ purple; hypothecium dark brown, K–. Asci 8-spored. Ascospores colorless, pale brown green when over-mature, submuriform, with a halo, 15–22.5(–27.5) × 7.5–12.5(–14) µm. Conidiomata not seen.

Chemistry—Thallus K–, C–; medulla K–, C–. No substances detected by TLC.

Specimens examined: **CHINA. Sichuan, Litang**, Mt Kazila, alt. 4700 m, on siliceous rock, 7 Nov. 2008, Yuanda Du 20080111, 20180268 (SDNU).

Distribution—*Rhizocarpon subpostumum* has previously been reported from Norway, Sweden, Finland, Iceland, Great Britain (Scottish Highlands), North America, and New Zealand (Ihlen 2004, Galloway 2007, Fletcher & al. 2009). New to China.

Comments—Our specimens conform to previously published descriptions. *Rhizocarpon subpostumum* is characterized by small apothecia, small submuriform ascospores, and the K+ purple exciple. It shares small apothecia and ascospores with *R. postumum* (Nyl.) Arnold, which is distinguished by its exciple not reacting K+ purple (Fryday 2000, Ihlen 2004, Fletcher & al. 2009).

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The authors thank Dr. Patrick McCarthy (Canberra, A.C.T., Australia) and Dr. Shou-Yu Guo (State Key Laboratory of Mycology, Institute of Microbiology, Chinese Academy of Sciences, Beijing, China) for guidance in specimen identification and pre-submission review. We also thank the others in our laboratory for assistance during this study. This investigation was supported by the Emergency management project of National Natural Science Foundation of China (31750001), the National Natural Science Foundation of China (31900010) and the Scientific Research Foundation of Graduate School of Shandong Normal University (SCX201945).

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Zanclospora bicolorata sp. nov. from Ecuador

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Abstract—The new species *Zanclospora bicolorata,* found on a rotten leaf of an unidentified plant in Ecuador, is described and illustrated. The fungus is characterized by setiform bicolored conidiophores and amygdaliform to suballantoid unicellular hyaline conidia.

Key words—asexual fungi, hyphomycete, taxonomy, tropics

Introduction

Zanclospora S. Hughes & W.B. Kendr., typified by *Z. novae-zelandiae* S. Hughes & W.B. Kendr., is characterized by macronematous, mononematous, setiform, cylindrical, multiseptate, brown to dark brown conidiophores. The pale brown conidiogenous cells are monophialidic, lageniform or ampulliform, discrete, sessile, and arranged in verticils around the middle conidiophores. The hyaline unicellular conidia are falcate, cylindrical, or obovoid and accumulate in mucous masses (Hughes

& Kendrick 1965). During a survey of hyphomycetes associated with plant litter from a tropical rainforest at the Río Palenque Scientific Center near Cantón Buena Fé, Los Rios province, we collected a *Zanclospora* specimen that differs remarkably from all previously described species (Almeida & al. 2013, Hernández-Restrepo & al. 2017), which we propose as a new species.

Materials & methods

Samples of decaying plant materials were collected and placed in plastic bags for transport to the laboratory, where they were washed, treated according to Castañeda-Ruiz & al. (2016), and placed in moist chambers. Individual conidia were separated from the plant material by a mycological needle under a stereoscope and cultured on V8 agar (125 ml V8 juice + 18 g agar + 1000 ml distilled H_2O, pH 6.3). The V8 cultures were incubated at 25 ± 1°C in an irradiation box exposed to alternating 12 h periods of light (Vica FLB-20W T10 UV-lamp) and observed morphologically after five days. Colony colors were coded according to Rayner (1970). Mounts were prepared in polyvinyl alcohol-glycerol (8 g PVA in 100 ml H_2O + 5 ml of glycerol) and lactofuchsin (0.1 g acid fuchsin, 100 ml 85% lactic acid) following Carmichael (1955), or 90% lactic acid. Features were measured at 1000× magnification and photographed using a Zeiss Axioskop 40 microscope with bright field and phase contrast optics. The type specimen (metabolically inactive dried culture) was deposited in the herbarium of the Culture Collections of Microorganisms, CIBE Guayaquil, Ecuador (CCMCIBE).

Taxonomy

Zanclospora bicolorata R.F. Castañeda, M. Villav. & D. Sosa, **sp. nov.** Figs 1–3

MB 833992

Differs from *Zanclospora bonfinensis* by its bicolored conidiophores and amygdaliform or suballantoid conidia.

Type: Ecuador, Los Ríos province, Cantón Buena Fé, Parroquia Patricia Pilar, 0°35′45′S 79°21′49′W, on decaying leaf of an unidentified plant, 18.III.2019, coll. A. Quevedo, M. Vera & F. Espinoza (**Holotype** [metabolically inactive dried culture], CCMCIBE-H594)

Etymology: Latin, *bicolorata*, two-colored, referred to the conidiophores.

Colonies on V8 agar at 25°C attaining 35 mm diam after five days, adpressed, radially undulate, whitish-pale luteous. Reversed center orange-sienna, margin white. Mycelium mostly immersed, composed of septate, slightly branched, smooth, 1–4.5 µm diam, subhyaline to pale brown hyphae. Conidiophores macronematous, mononematous, setiform, erect, flexuous, cylindrical below, unbranched, acuminate to acerose toward the apex, 10–20-septate, with multiple adjacent verticils of conidiogenous cells on swollen cells, more or less

Fig. 1. *Zanclospora bicolorata* (ex holotype CCMCIBE-H594). Colonies on V8 culture medium. A. Viewed from above; B. Viewed from below.

at the middle of the stipe, at the middle part of conidiophores smooth-walled, pale brown or brown from the base to the distal verticils of conidiogenous cells, dark reddish brown toward the apex, ≤300 µm long, 10–17 µm wide.

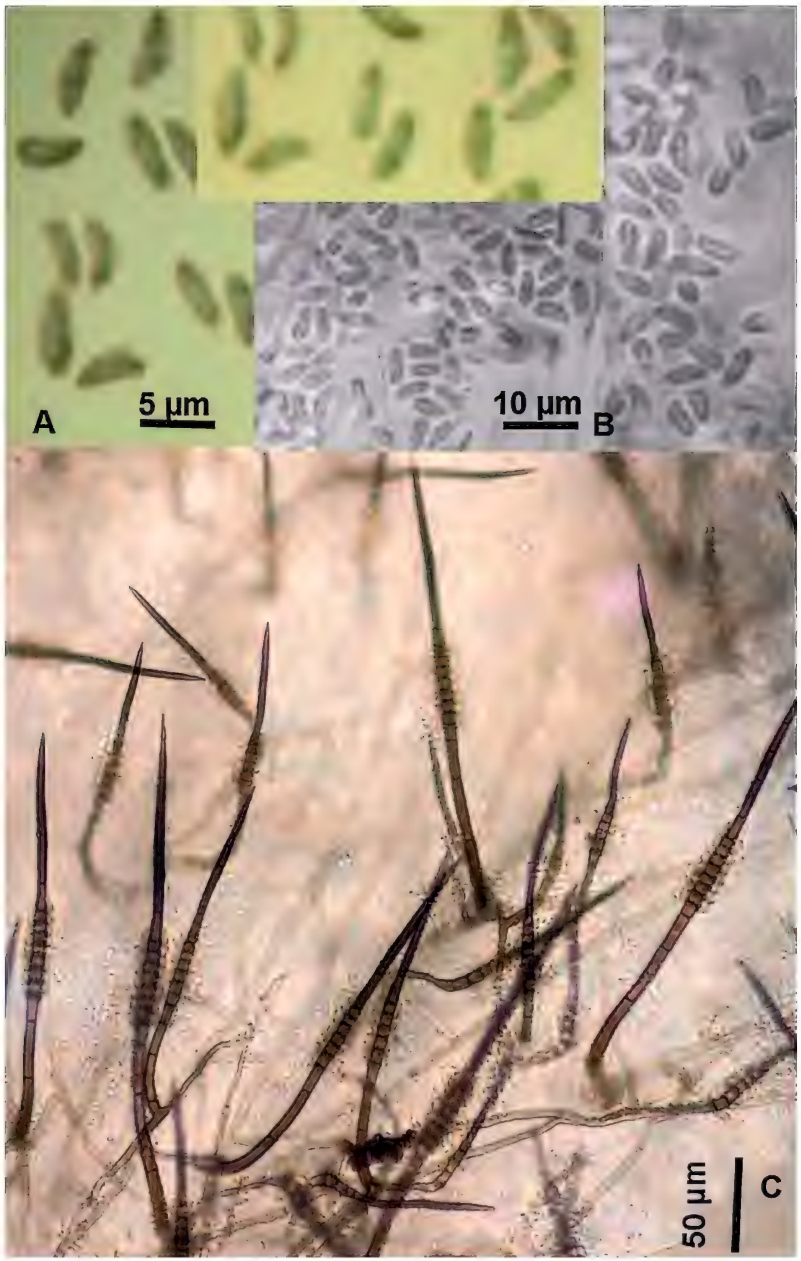

Fig. 2. *Zanclospora bicolorata* (ex holotype CCMCIBE-H594).
A, B. Conidia; C. Conidiophores, conidiogenous cells, and conidia.

Fig. 3. *Zanclospora bicolorata* (ex holotype CCMCIBE-H594).
A. Conidiogenous cells series forming verticils; B. Conidiogenous cells;
C. Conidiophores, conidiogenous cells, and conidia.

Conidiogenous cells monophialidic, ampulliform or lageniform, 6–15 × 2.5–4 µm, with inconspicuous to noticeable cylindrical-infundibuliform collarette, 1–5 × 1 µm, discrete, very pale brown, smooth-walled, 2–6 in verticils

adjacent just below the septa of swollen cells in ≤9 series on the conidiophores. Conidia seriate, amygdaliform to suballantoid, unicellular, hyaline, smooth-walled, 2–4 × 1–1.5 µm, accumulating in white masses.

Notes: *Zanclospora* is represented by eleven species and one variety (Almeida & al. 2013, Hernández-Restrepo & al. 2017, Index Fungorum 2020). *Zanclospora bicolorata* is morphologically similar to *Z. bonfinensis* D.A.C. Almeida & al. in the conidiophores and conidiogenous cell arrangement, but *Z. bonfinensis* is distinguished by its brown conidiophores with sterile stipe that is verrucose toward the apex and its straight to slightly curved bacilliform conidia (3–5.5 × 1–2 µm; Almeida & al. 2013).

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Regional annotated mycobiota new to the Mycotaxon website

Abstract—Mycotaxon is pleased to add a new annotated species distribution list to our 142 previously posted free access fungae. The 22-page "Additions to a checklist of coprophilous fungi and other fungi recorded on dung from Brazil: an overview of a century of research" by Francisco J. Simões Calaça, Vanessa Basilio Tereza, and Solange Xavier-Santos may be downloaded from our website via http://www.mycotaxon.com/mycobiota/index.html

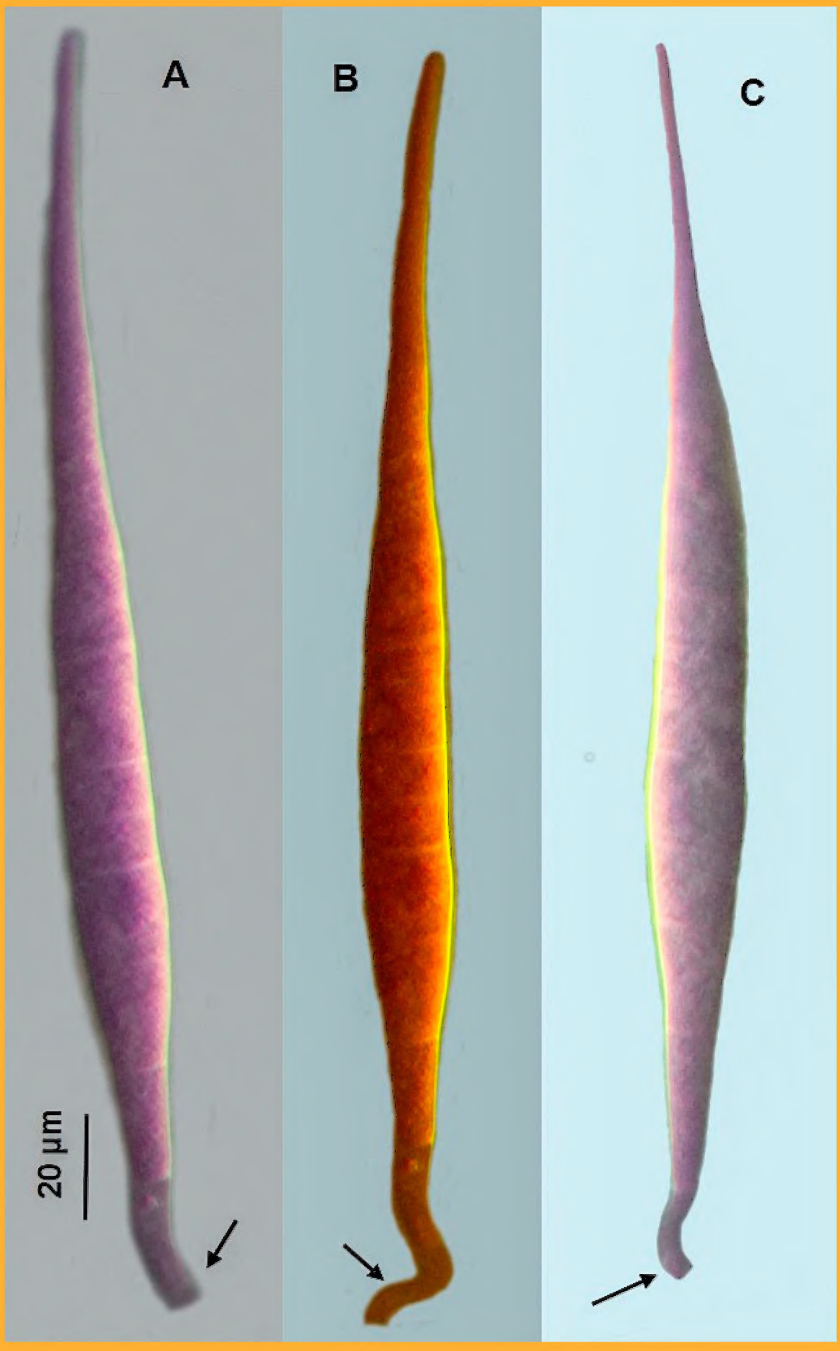
SOUTH AMERICA

Brazil

Francisco J. Simões Calaça, Vanessa Basilio Tereza, Solange Xavier-Santos. Additions to a checklist of coprophilous fungi and other fungi recorded on dung from Brazil: an overview of a century of research. 22 p.

Abstract—In 2014 we published the first checklist of fungi sensu lato recorded on dung from Brazil, as a result of an effort to maintain an easily accessible database on the knowledge of the diversity of these fungi. In the last 10 years there has been a significant increase in the number of publications involving this ecological group, and we are presenting an update which summarizes data from a century of research (from 1919 to 2019). We present an annotated list of all species and occurrences added to the Brazilian copromycodiversity, the annual accumulation of records, and occurrence by substrate. There were 302 records of 166 species, 98 of which are new for Brazil, all of them reported from seven Federation states (including two new). Most of the occurrences are reported from the northeast region of the country (Pernambuco and Piauí states), followed by the midwest (Goiás and Federal District) and southern regions (Paraná and Rio Grande do Sul). Amazonas and Piauí are states with new records of these organisms, with one record each. There are now 568 occurrences and 308 species of dung-inhabiting fungi recorded in Brazil.

Key words—dung-inhabiting fungi, new occurrences, species distribution, substrates



Similitrichoconis wongii sp. nov.
(Vera & al.— Fig. 5, p. 837)